University of Alberta

The Economics of Chronic Pain and the Stated Preference Valuation of Chronic Pain Disorders

by

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ABSTRACT

Objectives: The objectives of this thesis was to: 1) review the literature to examine economic evaluations and willingness to pay studies in chronic pain, 2) determine the association between modifiable health influencing activities and change in health status over one year in persons with chronic migraine, 3) measure the willingness to pay (WTP) for improvements in pain related morbidity (PRM) in persons with chronic pain.

Methods: For the first objective, drawing on available evidence that have appeared in the medical and economic literature, economic evaluations and WTP in chronic pain were searched on selected databases from 2002-2006. For the second objective, a linear regression analysis was applied to the Canadian Community Health Survey Cycle 1.1. The dependent variable was reported health status change over time. Explanatory variables consisted of a series of health care utilization, health behaviour, and background control variables. For the third objective, a discrete choice experiment was administered to measure WTP in 178 respondents attending the University of Alberta Multidisciplinary Pain Centre.

Results: For the first objective, there were 3,935 studies identified. Sixteen studies met the inclusion/exclusion criteria and were included in the review. For the second objective, health status was positively associated with higher levels of physical activity and negatively associated with smoking for both migraineurs and non-migraineurs even when controlling for all other variables. For the third objective, persons with chronic pain are willing to pay $532 to $1,428 per month out of pocket to minimize their pain related morbidity which translates to approximately $6,400 to $17,000 per year.

Conclusions:

For the first objective, the majority of economic evaluations in chronic pain were in back pain and there was a wide variability in the economic quality of the studies. WTP also seems to be a viable approach for assessing patient preferences for chronic pain treatments. For the second objective, modifying controllable resources and behaviours can improve the health status of migraineurs as effectively as non-migraineurs. For the third objective, persons with chronic pain are ready to allocate a significant portion of their total annual family income to minimize PRM. Furthermore, treatment and management strategies that focus on reducing pain intensity would have the greatest impact on improving health related quality of life.

DEDICATION

I dedicate this thesis to my father, Chuan Chuck, who taught me that education above all is the key to success and personal growth. He also taught me to strive for excellence not only in my ambitions, but more importantly, in my everyday life. I also dedicate this thesis to my mother Linda, brothers Christopher and Marvin, grandmother Wai Kong Chiok and my other half Sheena Gullekson.

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CHAPTER 1: INTRODUCTORY CHAPTER

1.1 BACKGROUND

Pain is defined, by the International Association for the Study of Pain, as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage."[1] Chronic pain has been defined as pain lasting longer than 3 months while other definitions require that pain persist longer than 6 months. Still, other definitions of chronic pain define chronic pain as pain lasting longer than the temporal course of natural healing that is associated with a particular type of injury or disease process.[2]

The burden of chronic pain to society is considerable. Using the IASP definition of chronic pain, a systematic review conducted in 2002 indicates that the prevalence of chronic pain is approximately 35.5%.[3] Over 50 million individuals suffer from chronic pain in the United States,[4] while in Canada, chronic pain affects 27% of men and 31% of women with 80% being moderate or severe in severity.[5] The economic consequence of chronic pain is significant with effects spilling over into many sectors of society. The costs of healthcare services are estimated to exceed 33.6 billion USD per year while the costs of disability compensation, lost productivity and legal fees are estimated at 43 billion, 4.6 billion and 5 billion USD respectively.[6] Other American estimates of lost productivity have been as high as $50 billion USD per year.[7] Furthermore, pain has been listed as the most common reason for seeking medical care,[7] and it is not surprising that the cost of healthcare for persons with chronic pain has been estimated to exceed that of coronary artery disease, cancer and AIDS combined.[8]

It is of great concern that the prevalence of chronic pain is expected to increase as a result of demographic shift in the elderly population and by the rising incidence of musculoskeletal pain conditions.[9] What is more frightening is that substantial healthcare resources are already directed at chronic pain but many barriers to appropriate pain management persist.[10] In light of the increasing budgetary constraint and public demands of accountability in the health care system, decision and policy makers are faced with difficult allocative decisions concerning how health care services targeted at chronic pain are to be provided and funded. There are treatments available that potentially reduce pain intensity but are associated with higher costs.

Development of more effective and cost-effective treatment and management strategies will become increasingly important to ameliorate the escalating demand for already stretched and scarce health care resources. Economic analyses are therefore critical components to inform policies and strategies aimed at improving chronic pain and ameliorating the detrimental effects to society. Firstly, economic research in chronic pain provides insights into which competing chronic pain interventions provide the most health improvements for the lowest cost (i.e. cost-effectiveness). Identifying interventions that are cost-effective will provide guidance to decision makers regarding allocative decisions of scarce health care resources. Secondly, economic research can identify modifiable health activities that can improve the health status of persons with chronic pain (i.e. health production). Identifying how persons with chronic pain manage their condition from the viewpoint of resource utilization and personal health behaviours may provide insights that lead to more effective care strategies. Thirdly, economic research can identify patient preferences for attributes of improvement in pain related morbidity (PRM) while informing the economic value of reducing PRM. Determining patient preferences would elucidate the relative value of improving pain intensity and/or pain related disability (PRD) for persons with chronic pain. Quantifying the Economic burden of PRM which have implications on issues related to funding, reimbursements and compensation.

1.2 RESEARCH PURPOSE & RESEARCH QUESTIONS

Economic analyses can therefore offer a significant contribution to chronic pain research. A number of economic evaluations measuring the cost-effectiveness of various pain interventions are available. A review and synthesis of this evidence would elucidate to decision and policy makers the interventions that are not only effective and efficacious but also cost-effective.

A critical component of pain management programs is the emphasis of self empowerment and self-directed change.[11] Even the most effective and cost-effective interventions are unlikely to significantly ameliorate the burden chronic pain places on society and individuals with chronic pain will need to bear some responsibility for properly managing their chronic pain. Thus, identifying modifiable health behaviours that persons with chronic pain can adopt to improve their quality of life is important to providing a diverse management approach.

Because persons with chronic pain bear responsibility for managing their chronic pain, it is also critical that treatment and management programs incorporate patient preferences for various attributes of pain related improvement (e.g. prefers pain relief or disability improvement) indicated by their WTP for attributes of pain related improvement. Management programs that incorporate patient preferences will have a greater potential for positively impacting health related quality of life. Additional benefits of such WTP studies is that they will provide an estimate of the economic burden associated with the chronic pain health state, which have not been included in previous estimates of the economic burden. Adding the economic value of the chronic pain health state to estimates of direct health service costs and lost productivity will allow for cost benefit studies in the future. Cost benefit analysis is considered the highest level of economic evaluation[4] because it allows decision makers to directly compare pain interventions in monetary terms.

In light of these three areas where economics can contribute to pain research, this thesis has three objectives. The first objective is to review the published literature concerning economic evaluations and willingness to pay studies in chronic pain. Specific research questions are as follows:

1) How many full economic evaluations have been conducted in chronic pain?

2) Which interventions for chronic pain have shown evidence of cost-effectiveness?

3) Has willingness to pay (WTP) been used in chronic pain to determine the economic burden associated with pain related morbidity or the preferences for various aspects of pain treatment (e.g. mode of administration, duration of relief, etc.)?

4) Is willingness to pay (WTP) a viable research approach in chronic pain?

The second objective is to conduct a health production function for persons with chronic migraine headaches. Specific research questions are as follows:

1) What is the association between modifiable health influencing activities (e.g. physical activity) and changes in health status in migraineurs?

2) What is the impact of modifiable health influencing activities on health status from a population perspective *in situ*? For policy – making purposes, it is important to know the health behavior and outcomes of persons with migraine under everyday conditions.

The third objective is to measure the WTP for improvements in pain related morbidity in persons with chronic pain. Specific research questions are as follows:

1) What are persons with chronic pain WTP for improvements in their pain related morbidity?

2) Do persons with chronic pain prefer reductions in pain intensity or improvements in their pain related morbidity (PRM)?

3) What is the monetary value of being in the pain health state? That is, what is the economic burden associated with PRM?

4) Does WTP differ by demographic and clinical characteristics?

1.3 SUMMARY OF THESIS FORMAT

This thesis is organized in a paper format. Chapters 2 through 4 are separate manuscripts addressing the three objectives outlined in the previous section. Chapter 2 is a review of the literature examining economic evaluations and WTP studies in chronic pain. Chapter 3 is original research examining modifiable health producing factors for persons with chronic migraine headache. In a regression model I measured the relationship between modifiable health producing activities and changes in health status over one year. This paper has been accepted for publication in the journal, Pain Research and Management. Chapter 4 is original research examining the WTP for improvements in PRM in persons with chronic pain. A discrete choice experiment was used to measure the stated preference for levels of pain reduction and improvement to pain related disability. Chapter 5 summarises and draws conclusions about the research presented in Chapters 2 through 4.

1.4 REFERENCES

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CHAPTER 2: REVIEW OF ECONOMIC EVALUATIONS AND WILLINGNESS TO PAY STUDIES IN CHRONIC PAIN

2.1 INTRODUCTION

The cost of healthcare for persons with chronic pain has been estimated to exceed that of coronary artery disease, cancer and AIDS combined.[1] Still, while health care expenditures associated with chronic pain are significant, they represent only a small percentage of total costs attributable to chronic pain. The majority of costs attributable to chronic pain are associated with compensation issues and lost productivity. For instance, while the costs of healthcare services are estimated at over US$33.6 billion, the costs of disability compensation, lost productivity and legal fees are estimated at US$43 billion, US$4.6 billion and US$5 billion respectively.[2]

There is an extensive assortment of treatments available for persons with chronic pain including pharmacological treatments (e.g. opioids, nonsteroidals), operative procedures, physical stimulation (transcutaneous electrical nerve stimulation), anesthesia, neural augmentation (spinal column stimulators), implantable delivery systems and rehabilitation programs. Given the plethora of available treatments, economic evaluations in chronic pain are important because while available treatments offer promise in terms of ameliorating the effects of chronic pain, they are associated with increased cost.

The objective of the study was to conduct a review of published economic evaluations in chronic pain and synthesize the evidence regarding interventions shown to be cost-effective. The objective was to also determine whether willingness to pay (WTP) has been used to measure patient preferences for attributes of pain reduction.

2.2 METHODS

2.2.1 Data Sources

Drawing on available evidence that have appeared in the published literature, CEA, CBA and WTP studies were searched on selected databases from 2000 to 2007 (see Appendix 2-A for search strategy). PubMed, Medline®, EMBASE®, HealthSTAR®, PsycINFO®, ERIC®, CINAHL® and AMED ® were searched using MeSH terminology, descriptors, and text words for pain and economic evaluations. Using the same search headings and keywords, EconLit, Health and Psychosocial Instruments, International Pharmaceutical Abstracts, and the Centre for Reviews and Dissemination [and its databases including NHS Economic Evaluation Database (NHS EED), and Heath Technology Assessment (HTA)], Evidence Based Medicine Reviews: Database of Abstracts of Reviews of Effects (DARE), and the Cochrane Register of Controlled Trials was searched.

2.2.2 Study Selection

The search was limited to human and English language publications. Inclusion criteria for retrieval of full-text articles were that:

1. The study was about chronic pain. Chronic pain was defined as pain that persists longer than the temporal course of natural healing that is associated with a particular type of injury or disease process.[3] A more inclusive definition of chronic pain was used to allow for a greater number of articles being included in the review.

2. The study was a full economic evaluation that assessed both costs and outcomes for at least two competing alternatives. CUA must have been conducted with a

validated preference based health related quality of life measure; otherwise it was categorized as a CEA. Review articles of economic evaluations in chronic pain were also included.

3. The study was about WTP for improvements in chronic pain related morbidity (PRM).

Studies not about chronic pain or economics were discarded based on their titles and abstracts. Full-text articles of remaining studies were retrieved for review.

2.2.3 Data Extraction and Synthesis

Extracted data from included studies were: place of origin, pain condition, method of patient recruitment, healthcare setting, timelines, economic evaluation type (e.g. CEA), study type (e.g. randomized controlled trial (RCT)), perspective (e.g. societal), intervention, comparator, costing methodology (e.g. healthcare services included, unit costs), unit of output (e.g. quality adjusted life years), study results and study conclusion. Information generated from extracted data was synthesized into four sections: review articles, willingness to pay, CBA and CEA/CUA.

2.2.4 Quality Assessment

Quality assessment was conducted using criteria adapted from Drummond *et al.*[4] There are ten quality criteria with specific points listed within each criterion. Each criterion and each point within the criterion was given a weighting score of one. Therefore the highest quality score a study could receive was 33 (see Appendix 2-B).

2.3 SEARCH RESULTS

The search generated 3,935 articles (figure 1). After reviewing their titles and abstracts, 48 studies about pain and economics remained and were retrieved for further evaluation. Of the 48 articles, 16 met the inclusion/exclusion criteria and were included in the review. Table 2-1 provides a summary of the articles included in the review.

2.4 REVIEW FINDINGS

2.4.1 Review Studies

Tella *et al.*[5] conducted a review of twelve economic evaluations in rheumatology between 2001 and 2002 that targeted osteoporosis, rheumatoid arthritis, cyclooxygenase-II inhibitors, total joint replacement, back pain and lyme disease. However, the studies in osteoporosis (4 studies) and Lyme disease (1 study) are not discussed in the review because the evaluations did not target pain. Furthermore, one study in back pain was excluded because it targeted acute pain[6] while another was excluded because it was not full economic evaluation.[7] Table 2-2 summarises the economic evaluations in chronic pain reviewed by Tella *et al.*[5]

Figure 2-1 Progress through Selection of Potentially Relevant Studies

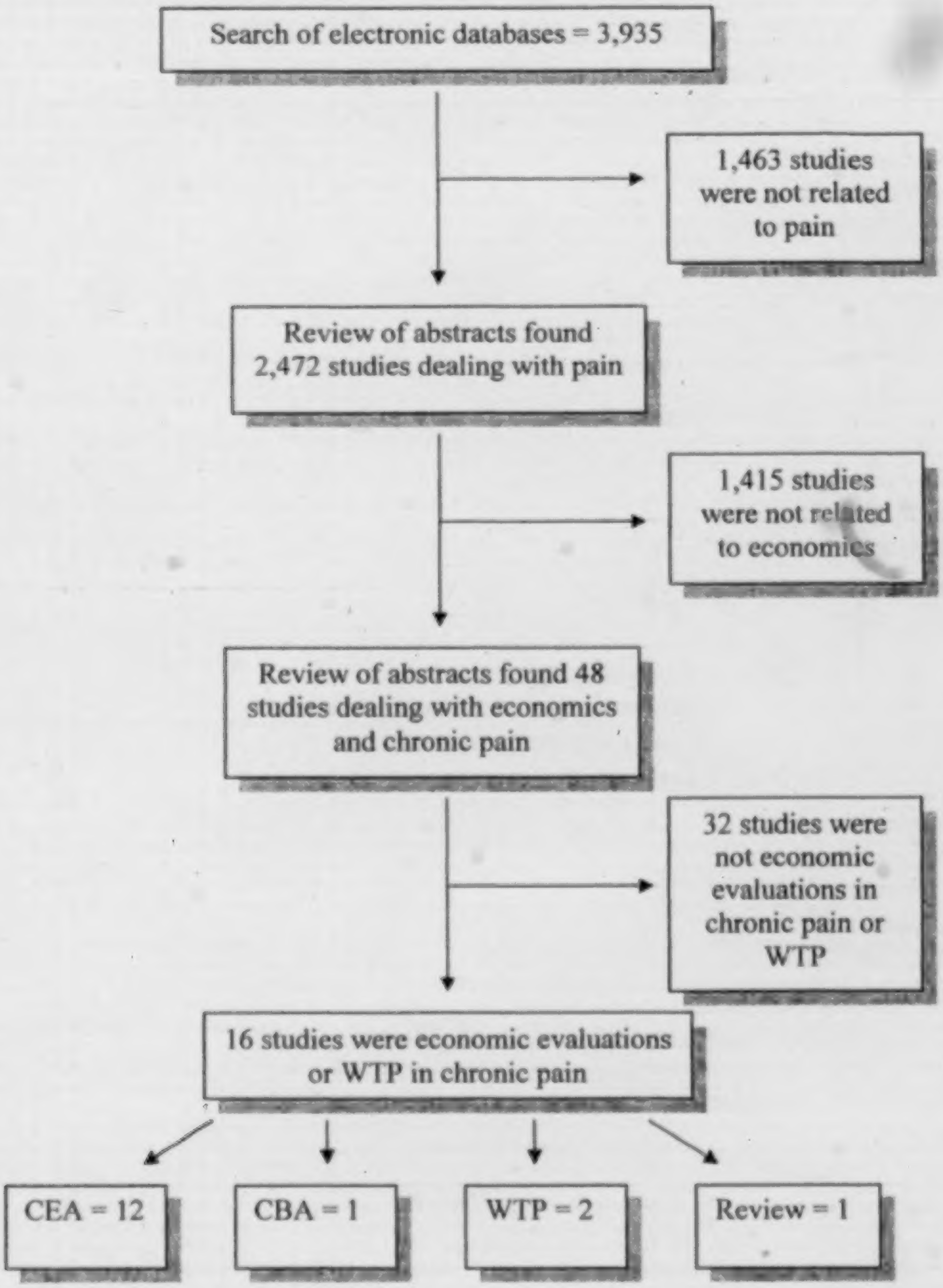
Search of electronic databases = 3,935
1,463 studies were not related to pain
Review of abstracts found 2,472 studies dealing with pain
1,415 studies were not related to economics
Review of abstracts found 48 studies dealing with economics and chronic pain
32 studies were not economic evaluations in chronic pain or WTP
16 studies were economic evaluations or WTP in chronic pain
CEA = 12
CBA = 1
WTP = 2
Review = 1

Table 2-1 Summary of Economic Evaluation Papers in Chronic Pain

Author	Quality Score	Country	Study Type	Pain Condition	Setting	Perspective	Timeline	Technology	Results	Conclusion
Cross *et al.* (2002)[8]	NA	Australia	WTP (Survey)	Osteo-arthritis	Hospital	Patient	NA	total knee (THK) or total hip (THR) replacement	THR: 71% WTP something, 11% WTP nothing. TKR: 70% WTP something, 16% WTP nothing.	WTP was understandable and acceptable to patients.
Lenert (2003)[9]	NA	USA	WTP (Survey)	Migraine	Web-based	Patient	NA	Hypothetical pharmaceutical treatment	Median WTP for ideal treatment = USD$130 per month.	Wide variability in preferences for migraine treatment. WTP is a valid metric for quantifying treatment preferences in migraine.
Skouen *et al.* (2002)[7]	18/33	Norway	CBA (RCT)	Low Back	Primary Care	Employer	2 yrs	Usual care vs. 1) light multidisciplinary 2) extensive multidisciplinary	Productivity gains from light multidisciplinary Treatment was USD$924,500 for men.	Light Multi-disciplinary treatment is cost-effective.
Kovacs *et al.* (2002)[10]	18/33	Spain	CUA (RCT)	Low Back	Primary Care	Payer	Did not report	Neuroreflexotherapy + usual care vs. usual care	USD-$1864 per QALY gained (inferior to usual care).[a]	Neuroreflexotherapy is cost-effective.[b]
Miller *et al.* (2002)[11]	24/33	United Kingdom	CEA (RCT)	Low Back	Primary Care	Societal	9 months	Lumbar Spine Radiography vs. usual care	No differences in QALY 9 months post randomization. Used satisfaction as outcome measure. £20 per unit of satisfaction gained.	Lumbar spine radiography is likely to be cost-effective when satisfaction is valued very highly (>£50).

Table 2-1 Continued Summary of Economic Evaluation Papers in Chronic Pain

Author	Quality Score	Country	Study Type	Pain Condition	Setting	Perspective	Timeline	Technology	Results	Conclusion
Fritzell *et al.* (2004)[12]	28/33	Sweden	CEA (RCT)	Low Back	Hospital	Societal	2 yrs	Lumbar fusion vs. no surgery	USD$2,600 per unit improvement in back pain. USD$11,300 per person returned to work.	Lumbar fusion is cost-effective compared to no surgical intervention.
UK BEAM Trial Team (2004)[13]	29/33	United Kingdom	CUA (RCT)	Low Back	Primary Care	Payer	1 yr	Best care (BC) vs. BC + exercise (EP) program vs. BC + spinal manipulation (SM) vs. BC + EP + SM (combo)	BC vs. BC+EP= dominated by combo. BC vs. combo = £3800 per QALY gained. SM vs. combo = £8700	SM is a cost-effective addition to BC.
Niemisto *et al.* (2005)[14]	24/33	Finland	CUA (RCT)	Low Back	Hospital	Societal	2 yrs	Manipulative treatment+stabilizing exercise+GP consultation (Combo) vs. GP consultation alone	USD$512 per VAS unit gained.	For majority of nonspecific low back pain, GP consultation alone is the adequate treatment of choice.
Rivero-Aris *et al.* (2006)[15]	23/33	United Kingdom	CUA (RCT)	Low Back	Primary Care	Societal	1 yr	Physiotherapy treatment vs. advice from physiotherapist	No significant differences in either costs or outcomes.	Physiotherapy treatment is as cost-effective as advice from physiotherapist. [b]

Table 2-1 Continued Summary of Economic Evaluation Papers in Chronic Pain

Author	Quality Score	Country	Study Type	Pain Condition	Setting	Perspective	Timeline	Technology	Results	Conclusion
Strong *et al.* (2006)[16]	25/33	USA	CEA (RCT)	Low Back	Primary Care	Payer	1 yr	Usual care (UC) vs. self management program led by 1) psychologist (P) 2) lay person (L)	UC vs. P = USD$6.13 per additional low impact back day. UC vs. L = USD$9.70 per additional low impact back day.	P and L interventions are associated with better outcomes but with slightly higher costs compared to usual care.
Sevick *et al.* (2000)[17]	20/33	USA	CEA (RCT)	Knee Osteo-arthritis	Hospital	Payer	18 months	health education (HE) vs. 1) aerobic exercise (AE) 2) resistance exercise (RE)	HE vs. AE = USD-$114 per disability unit decreased & USD-$114 per pain unit decreased (HE dominated). HE vs. RE = USD-$117 per disability unit decreased & USD-$171 per pain unit decreased (HE dominated).	Compared to HE, RE is more economically efficient than AE.
Thomas *et al.* (2005)[18]	24/33	United Kingdom	CEA (RCT)	Knee	Primary Care	Payer/ Patient	2 yrs	Exercise therapy (ET) vs. no ET. phone support (PS) vs. no PS	ET vs. no ET = £2,570 per unit of clinical significant improvement in pain score.	ET associated with improvements in knee pain but cost of ET unlikely to be offset by any reduction in health resource use.
Korthals-de Bos *et al.* (2003)[19]	24/33	Nether-lands	CUA (RCT)	Chronic Neck Pain	Primary Care	Societal	1 yr	manual therapy (MT) vs. Physiotherapy (PT) vs. usual GP care (UC)	MT vs. UC = USD$-15505 per QALY (MT dominant). MT vs. PT = USD$-31,444 (MT dominant). PT vs.UC = $USD2688 per QALY.	Manual therapy (spinal mobilization) is more effective and less costly than physiotherapy or care given by GPs.

Table 2-1 Continued Summary of Economic Evaluation Papers in Chronic Pain

Author	Quality Score	Country	Study Type	Pain Condition	Setting	Perspective	Timeline	Technology	Results	Conclusion
Kemler *et al.* (2002)[20]	26/33	Netherlands	CUA (RCT)	Chronic Reflex Sympathetic Dystrophy	Hospital	Societal	1 yr	Spinal cord stimulation + physical therapy vs. physical therapy alone	€22,581 per QALY gained.	Spinal cord stimulation + physical therapy is cost-effective compared to physical therapy alone.
Pollock *et al.* (2005)[21]	21/33	USA	CEA (NRCT)	Trigeminal Neuralgia	Hospital	Payer	2 yrs	microvascular decompression (MD) vs. glycerol rhizotomy (GR) vs. stereotactic radiosurgery (SR)	MD vs GR = USD$2,655 per quality adjusted pain free year gained (QAPFY). [a] MD vs. SR) = USD-$244 per QAPFY (SR dominated). [a] GR vs. SR) = USD$6423 per QAPFY (SR dominated). [a]	General neurosurgical approach used to treat unresponsive trigeminal neuralgia is cost-effective.

Quality was assessed with criteria adapted from Drummond *et al.*[4] A score of 32 is the highest quality score.

RCT – randomized controlled trial NRCT – non randomized controlled trial

a. Incremental cost-effectiveness ratio (ICER) between interventions were not calculated. The correct ICER calculation is presented.

b. Indicates conclusion was inconsistent with results.

Table 2-2 Summary of Review by Tella *et al.*[5]

Author	Study Type	Context	Comparators/ Interventions	Results
Maetzel *et al.*[22]	CEA	Rheumatoid Arthritis	placebo vs. leflunomide or methotrexate	No improvements to utility. incremental analyses (i.e. cost-effectiveness ratios) were not performed
Marshal *et al.*[23]	CEA	Cyclooxygenase-II Inhibitors	rofecoxib vs. nonselective NSAID	ICER rofecoxib = $1,416 per perforations/ulcers/bleeds avoided
Fisman *et al.*[24]	CEA	Infected Total Joint Replacement	two-stage exchange arthroplasty vs. open dibridement with prosthesis retention	ICER dibridement = $500 to $21,800 per QALY gained
Karppinen *et al.*[25]	CEA	Back Pain	Periradicular infiltration for sciatica vs. no intervention	ICER periradicular infiltaration = 1) -$12,668 per QALY gained (dominant) for disc herniations. 2) -$4,445 per QALY gained (dominated) for disc intrusions.
Reddy *et al.*[26]	CBA	Back Pain	Pathogenic analysis after cervical and lumbar decompression	$70,000 with no benefits (i.e. no cases of abnormal pathology found).

2.4.2 Willingness to Pay

The search produced two WTP studies in chronic pain. Cross *et al.*[27]conducted a WTP study in patients undergoing primary total hip replacement. Patients who had undergone primary total hip or knee replacement completed a series of survey questionnaires that included a WTP survey. WTP was elicited using a bidding ladder with bids that ranged from $0 to $30,000. Respondents were asked to state their out of pocket WTP for total hip (n = 129) and total knee replacement (n = 109). Responses were then categorized as WTP something and WTP nothing. Results revealed that for total hip replacement, 71% were WTP something, 11% were not WTP anything and 18% did not answer. Results revealed that for total knee replacement, 70% were WTP something, 16% were not WTP anything and 14% did not answer. Covariates associated with WTP were lower postoperative pain score, income, age, health insurance and willingness to recommend joint replacement to others.

Lenert[9] conducted a WTP study in 257 migraineurs recruited through an internet website. WTP was assessed for a perfect pharmaceutical treatment and those less ideal. Perfect treatment was defined as working immediately, completely and with no adverse events. Attributes of less ideal drugs included 50% chance of rebound headache, unable to work afterwards, 2-hour delay in relief, incomplete pain relief, no relief of photophobia and no relief in nausea. WTP for treatment attributes were elicited via a web based bidding game with bids ranging from $1 to $1000. Prices were specified as out of pocket cost and on a per month basis. Results revealed that the median out of pocket WTP for an ideal migraine pharmacological treatment was $130 per month. Compared to the ideal treatment, WTP for less ideal treatments were reduced by 43% for treatments with 50% chance of rebound headache, 49% if unable to work afterwards, 57% for a 2-hour delay in relief, 58% for an incomplete relief of pain, 65% if there was no relief of photophobia and 74% if there was no relief of nausea.

2.4.3 Cost Benefit Analysis

The search produced one CBA in chronic pain. Skouen *et al.*[7] conducted a CBA of extensive and light multidisciplinary treatment programs compared with usual care for patients with chronic low back pain or on long term sick leave. Usual care is characterized by prescription medications and referrals to physiotherapists or chiropractors. Light multidisciplinary treatment was characterized by further clinical evaluation performed by physiotherapist, nurse and psychologist (1 hour with a physiotherapist, 30 to 60 minutes with a nurse and 1 hour with a psychologist).

Educational lectures promoting exercise, positive lifestyle behaviours, and fear-avoidance counseling were also provided. Extensive multidisciplinary treatment was characterized by treatment lasting for four weeks which included behavioral modification group sessions, education, exercises and workplace interventions. Patients with chronic low back pain were randomized into light multidisciplinary treatment program (n = 52), an extensive multidisciplinary program (n = 57) or usual care with their primary care physician (n = 86). Severity of PRM was not assessed.

Costs of treatments included operating expenses and wage payments at the clinic. Total costs were approximately $600,000 (1996 USD) and covered examination and treatment costs. Treatment benefits were operationalised as productivity gains from returning patients back to work. The difference in full return to work between treatment and controls (based on average number of months with full return to work from enrollment to the 24 month follow-up) multiplied by average annual earning for patients with low back pain who returned to work (approximately USD$28,000) constituted the estimate of treatment benefits (discounted at 3.5% in the second year).

The study received a quality score of 18 out of 33. Results indicate that compared to usual care light multidisciplinary treatment benefited men. There were no difference in benefit between usual care and extensive multidisciplinary treatment for men. Furthermore, there was no significant difference in any of the treatments and usual care for women. Societal gains in productivity for the 57 men enrolled in light multidisciplinary treatment during the first two years was USD$852,000.

2.4.4 Cost-effectiveness/Utility Analysis

The search produced 12 CEA or CUA in chronic pain. Pain conditions covered include back pain, knee pain, neck pain, chronic reflex sympathetic dystrophy and trigeminal neuralgia.

Low Back Pain

Kovacs *et al.*[28] conducted a CUA alongside a RCT comparing neuroreflexotherapy and usual care with usual care alone, from a payer's perspective. Patient recruitment was conducted by 25 general practitioners who recruited patients older than 17 years with non specific low back pain lasting 14 days or longer for which conventional treatment was unsuccessful. Neuroreflexotherapy (n = 59) consisted of temporary implantation of epidermal devices in specific points in the back and ear. Usual care (n = 45) consisted of usual management of low back pain in routine general practice. Costs included medications, primary consultations, emergency visits, hospital admissions, outpatient visits, imaging, diagnostic tests, rehabilitation, physiotherapy and surgery. Severity of pain intensity was derived by using a visual analogue scale (VAS) while severity of pain related disability (PRD) was measured using the Roland Morris Questionnaire.[29] The primary measure of effectiveness was QALY derived by using the EQ-5D. It is important to note that the authors failed to calculate the incremental cost-effectiveness ratio (ICER) between interventions but rather calculated ICER within interventions. The correct ICER between interventions (using the results reported in the study) was -$1,864 per QALY gained indicating that neuroreflexotherapy is dominated by usual care. However, the authors conclude that neuroreflexotherapy is cost-effective. The study received a quality score of 18 out of 33.

Miller *et al.*[11] conducted a CUA along side a RCT comparing lumbar spine radiography (n = 210) with usual care (n = 211) from a societal perspective. Fifty two general practices recruited patients with low back pain lasting 6 weeks or more in the past six months, who did not have serious spinal pathologies and did not received lumbar spine radiography in the past 12 months. The authors did not provide a description of lumbar spine radiography or usual care. Costs included costs of radiographs, inpatient admissions, outpatient attendance, general practitioner visits, physical therapy, medications, equipment, costs of practical help, heating bills, paying for gardening or housework, social security payments, loss of earnings and loss of productivity for employer. Severity of pain intensity was assessed using by the VAS and the severity of PRD was assessed using the Roland Morris Questionnaire.[29] The primary measure of effectiveness was QALY derived by using the EQ-5D and patient satisfaction derived by using self administered questionnaire. Results indicate that there are no differences in QALY nine months post randomization. The ICER when using satisfaction as the outcome measure is £20 per unit satisfaction gained. The authors conclude that lumbar spine radiography is likely to be cost-effective when satisfaction is valued at more than £50 per unit gained by society. The study received a quality score of 24 out of 33.

Fritzell *et al.*[12] conducted a CEA alongside a RCT comparing lumbar fusion (n = 217) with no surgical intervention from a societal perspective. Patients consisted of persons aged 15-65 who had severe and therapy resistant chronic low back pain of unknown origin of at least 2 years. Lumbar fusion consisted of either posterolateral fusion (n = 71), posterolateral fusion + variable screw placement device (n = 72), posterolateral fusion + variable screw placement device + interbody fusion (n = 74). No surgical intervention (n = 67) consisted of commonly used nonsurgical treatments according to existing practice. Costs consisted of hospital visits, inpatient days, diagnostic tests, equipment, surgical procedures, overhead, production loss and family expenses. Severity of pain intensity was assessed using the VAS (scale 0-100) and the severity of PRD was assessed using the Oswestry Disability Index.[30] The primary measure of effectiveness was unit of pain improvement derived by using VAS and number of persons returned to work. The results indicate that the ICER between lumbar fusion and no surgery is USD$ 2,600 per unit improvement in back pain and USD $11,300 per person returned to work. The authors conclude that lumbar fusion is cost-effective compared to no surgical intervention. The study received a quality score of 28 out of 33.

The UK BEAM Trial Team[31] conducted a CUA alongside a RCT comparing best care (n = 326), best care + exercise program (n = 297), best care + spinal manipulation (n = 342) and best care + exercise program + spinal manipulation (n = 322), from a payer's perspective. Best care consisted of trained practice teams providing "active management" and a book called "The Base Book." The exercise program consisted of an initial assessment and up to nine classes in a community setting over 12 weeks. Spinal manipulation consisted of a package of techniques developed and approved by the UK chiropractic, osteopathic and physiotherapy professions. Costs consisted of general practitioner consultations, other clinician services (e.g. nurses, physiotherapy), hospital inpatient days, outpatient services, inpatient services and costs of interventions. Severity of pain intensity and PRD was not directly assessed. The primary measure of effectiveness was QALY derived by using the EQ-5D. The ICER between best care and best care + exercise + spinal manipulation was £3,800 per QALY gained. The ICER between spinal manipulation and all interventions was £8,700 per QALY gained. All interventions also dominated (extended dominance) the comparison between best care and the exercise program. The authors conclude that spinal manipulation is a cost-effective addition to best care for the treatment of chronic low back pain. The study received a quality score of 29 out of 33.

Niemisto *et al.*[14] conducted a CUA alongside a RCT comparing general practitioner consultation with general practitioner consultation + manipulative treatment + stabilizing exercises, from a societal perspective. Participants were aged 24 to 46 years who were employed and who had an Oswestry Disability Index[30] score of at least 16%. General practitioner consultation (n = 100) consisted of radiography, educational booklet, individual instructions regarding posture and up to four exercises aimed at increasing spinal mobility and muscle stability. Manipulative treatment and stabilizing exercises (n = 98) consisted of one hour evaluation, treatment and exercise sessions focusing on muscle energy, motor control and stabilization once a week for four weeks. Costs included health services costs, direct drug and traveling costs to the patients, and productivity costs as a result of absence from work. Severity of pain intensity was assessed using by the VAS (scale 0-100) and the severity of PRD was assessed using the Oswestry Disability Index.[30] The primary measure of effectiveness was QALY derived by using the 15-D. Neither costs nor effectiveness were discounted. There was no difference in QALY scores 24 months post randomization but there was an improvement in VAS scores. The ICER using the VAS was USD$512 per VAS unit gained. The authors concluded that for the majority of non specific low back pain, GP consultation alone is an adequate treatment. The study received a quality score of 24 out of 33.

Rivero-Aris *et al.*[15] conducted a CUA alongside a RCT comparing physiotherapy treatment with physiotherapeutic advice from a societal perspective. Participants were persons with back pain lasting for longer than six weeks. Physiotherapy treatment consisted of physical examination and up to five treatment sessions of approximately 30 minutes in accordance with diagnosis made by the physiotherapist. Physiotherapists were requested to limit treatment to joint mobilization, soft tissue techniques, exercise, heat or cold treatment and advice. Physiotherapeutic advice consisted of one 1 hour session with a physiotherapist who performed a physical examination and gave general advice to stay active. Costs consisted of health service costs, patient out of pocket expenses and lost productivity from employment. Severity of pain intensity and PRD was not directly assessed. The primary measure of effectiveness was QALY derived by using the EQ-5D. There were no significant differences in either costs or outcomes. The authors concluded that physiotherapy treatment is as cost-effective as physiotherapeutic advice. However it is noteworthy to mention that the conclusions are misleading because an incremental comparison between the alternatives was not performed and as a result, claims of cost-effectiveness are misapplied. The study received a quality score of 23 out of 33

Strong *et al.*[16]conducted a CEA using data collected in two RCTs. The first trial compared usual care (n = 87) with self management led by a psychologist (n = 91) while the second trial compared usual care (n = 90) with self management led by a lay person (n = 103). The economic evaluation was conducted from a payer's perspective. Recruitment in the trials were conducted by mailing invitation letters to patients aged 25-

70 years who recently visited a primary care provider for back pain who were not being considered for surgery and expressed interest in learning about self care for back pain. Patients who received usual care received the book "Augustus White's Your Aching Back: A Doctor's Guide to Relief". Self management consisted of education sessions focusing on resuming normal activities, addressing common fears and physical activity. Costs included general practitioner visits, specialist visits, inpatient days, physical therapy, procedures (e.g. MRI), prescriptions and cost of interventions. Severity of pain intensity was not directly assessed while severity of PRD was assessed using the Roland Morris Questionnaire.[29] The primary measure of effectiveness was low back pain days which were derived by converting disability scores from the Roland Disability Questionnaire. The ICER between usual care and the psychologist led self management was USD$6.13 per additional low impact back day. The ICER between usual care and the lay led self management program was USD$9.70 per additional low impact back day. The authors concluded that psychologist and lay led self management programs are associated with better outcomes but with slightly higher costs compared to usual care. The study received a quality score of 25 out of 33.

Knee Pain

Thomas *et al.*[32] conduced a CEA along side a RCT comparing exercise therapy with no exercise therapy and phone support with no support, from a patient/payer perspective, in patients with chronic knee pain. Patients were sent a postal questionnaire identifying those with knee pain, >=45 years of age and registered at 2 general practice clinics. Exclusion were those with total knee replacement, limb amputation, cardiac pacemaker and no consent (n=759). The exercise program included quadriceps strength training and aerobic exercises. A research nurse provided the program in participant homes. Initial visits consisted of 4 visits lasting 30 minutes for the first 2 months with follow-up visits conducted every 6 months. Telephone support consisted of monitoring symptoms and providing advice on pain management. Telephone calls lasted 2 minutes with initial calls lasting 8 minutes. Costs included physician costs, prescribed medications, secondary care services (i.e. hospital care) and cost of the interventions themselves. Severity of pain intensity and PRD was not directly assessed. The primary measure of effectiveness was clinical significant improvement in knee pain (50% improvement at 24 months) derived by using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC).[33] The incremental cost-effectiveness ratio (ICER) between exercise therapy and no exercise therapy at £2,570 per unit of clinical significant improvement in pain score (note that there was no difference in outcome between phone therapy and no phone therapy and therefore no further analysis on phone therapy was conducted). The authors conclude that exercise therapy is associated with improvements in knee pain but the cost of delivering exercise therapy will not be offset by reductions in health care use. The study received a quality score of 24 out of 33.

Sevick *et al.*[17] conducted a CEA along side a RCT comparing health education with aerobic exercise or resistance exercise, from a payer's perspective, in patients with knee osteoarthritis. Patients were recruited through mass mail solicitation. Eligibility included being older than 60 years and having pain in one knee with related knee pain disability. Health education (n = 149) consisted of 90 minute videotaped presentation on general topics related to osteoarthritis initially followed by regular contact to discuss their arthritis and any problems with medications. Aerobic exercise (n = 144) and resistance training (n = 146) programs consisted of a 3 month facility based program and a 15 month home based program. Aerobic exercises included 60 minute sessions of slow walking, calisthenics and stretching. The resistance training program consisted of 3 month. Resistance exercises included lower and upper body exercises of major muscle groups. Costs included medical consultations and costs of interventions (equipment, labour, supplies, and adverse events). Severity of pain intensity was assessed using an instrument specifically designed for the study while the severity of PRD was not directly assessed. The primary measure of effectiveness was unit improvement in knee pain derived by using the WOMAC.[33] Results indicate that health education is dominated (more costly and less effective) by both aerobic and resistance exercise programs but less so by the aerobic exercise program. The authors conclude that compared to health education, the resistance exercise program is more economically efficient than the aerobic exercise program. The study received a quality score of 20 out of 33.

Neck Pain

Korthals-de Bos *et al.*[34] conducted a CUA alongside a RCT comparing manual therapy, physiotherapy and general practitioner care, from a societal perspective, in patients with neck pain. Patients with neck pain were recruited by their general practitioner. Eligibility included patients aged 18-70 years with neck pain of unknown cause lasting for at least a 2 week period who did not receive physiotherapy or manual therapy in the previous 6 months and who never had neck surgery. General practitioner care (n = 64) consisted of standard primary care services including discussion of prognosis, triggers, self care and ergonomic considerations. Medications were prescribed if necessary. Manual therapy (n = 60) consisted of muscular and spinal mobilization provided by registered manual therapists. There was a maximum of six sessions lasting 45 minutes scheduled once per week. Physiotherapy (n = 59) consisted of relaxation exercises, stretching, functional exercises, massage and manual traction. There was a maximum of 12 sessions lasting 30 minutes scheduled twice per week. Costs included direct health care costs (e.g. general practitioner, physiotherapist, manual therapist, hospitalisation, outpatient appointment, and professional home care), indirect health care costs (e.g. Alternative therapist, home care, travel costs, help from caregivers) and absenteeism (e.g. paid work and unpaid work). Severity of pain intensity was assessed using an eleven point pain scale designed specifically for the study while severity of PRD was assessed using the neck disability index. The primary measure of effectiveness was QALY derived by using the EQ-5D. Results indicate manual therapy dominates both general practitioner care and physiotherapy. The ICER between physiotherapy and general practitioner care is $USD 2,688 per QALY gained. The authors conclude that manual therapy is more effective and less costly than both physiotherapy and general practitioner care. The study received a quality score of 24 out of 33.

Chronic Reflex Sympathetic Dystrophy

Kemler *et al.*[20] conducted a CUA alongside a RCT comparing spinal cord stimulation and physical therapy (n = 36) with physical therapy alone (n = 18), from a societal perspective, in patients with chronic reflex sympathetic dystrophy. Patient recruitment consisted of the department of surgery referring all patients with chronic reflex sympathetic dystrophy into the study. Costs included routine reflex sympathetic dystrophy costs (e.g. medical care, physical therapy, transportation to and from care facilities, medications and physical aids) and out of pocket expenses (e.g. patient and family out of pocket expenses). Severity of pain intensity was and the severity of PRD was not directly assessed. The primary measure of effectiveness was QALY derived by using the EQ-5D. Results indicate that the ICER is €22,581 per QALY gained. The authors conclude that spinal cord stimulation and physical therapy is cost-effective compared to physical therapy alone. The study received a quality score of 26 out of 33.

Trigeminal Neuralgia

Pollock *et al.*[21] conducted a CUA alongside a non-RCT comparing microvascular decompression (n = 33), glycerol rhizotomy (n = 51) and stereotactic radiosurgery (n = 69), from a payer perspective, in patients with trigeminal neuralgia. Patients undergoing surgery for idiopathic trigeminal neuralgia were recruited to participate in the study. Costs included costs of each procedure, additional surgical costs and morbidity costs. Severity of pain and PRD was not directly assessed. The primary measure of effectiveness was quality adjusted pain free days (QAPFD) derived by using facial pain scores adjusted to be anchored between 0.1 (poor) and 1 (good). It is important to note that the authors failed to calculate the ICER between interventions but rather calculated ICER within interventions. This report calculates the ICER between interventions using the results reported in the study. Results indicated that both microvascular decompression and glycerol rhizotomy dominated stereotactic radiosurgery. The ICER of microvascular decompression versus glycerol rhizotomy was USD $2,655 per QAPFD gained. The authors conclude that general neurosurgical approach is cost-effective for treating unresponsive trigeminal neuralgia. The study received a quality score of 21 out of 33.

2.5 DISCUSSION

Between 2000 and 2006 there have been 16 economic evaluations (including a review by Tella *et al.*[5]) of various treatments in chronic pain. Seventy five percent of the economic evaluations were CEA/CUA. Ten economic evaluations were conducted in chronic back pain with fewer being conducted for other pain modalities. For chronic back pain, cost-effective interventions included lumbar spine radiography, lumbar fusion, spinal manipulation, self management programs and periradicular infiltration. The review also revealed that compared to usual care there is a net monetary gain in society to treat men with light multidisciplinary treatment. For neck pain, manual therapy dominates both physiotherapy and general practitioner care. For chronic reflex sympathetic dystrophy, spinal cord stimulation in combination with physical therapy is cost-effective compared to physical therapy alone. In knee pain, both aerobic and resistance exercise dominates health education alone.

Furthermore, there were only two WTP studies in chronic pain. The economic burden of the chronic pain state has not been addressed. However, WTP is a viable method for eliciting patient preferences for treatment attributes in chronic pain research. The welfare measures generated from the two WTP studies were consistent with a priori hypotheses and theoretical constructs of WTP (e.g. positive association between WTP and income).

The quality score of the economic evaluations ranged between 18 and 29 out of 33 possible points indicating a wide variability in the economic quality of the studies. However, it is important to mention that because 1 point was given to each criterion and sub-criterion outlined in Drummond et al.[4], greater weight is placed on criterion with a greater number of sub-categories. Thus, the scoring algorithm used to assess quality implicitly adopts the value judgment that criterion with a greater number of sub-categories are of higher importance in terms of their contribution to the overall quality of the economic studies reviewed. Health economists however, have yet to reach a consensus regarding the relative importance of the each criterion and it is therefore important to highlight the limitation associated with quality scoring criteria used in this literature review. What can be inferred from the scoring criteria is the relative quality between the economic studies reviewed because the same scoring algorithm was applied to each study included in the review.

2.6 CONCLUSIONS

Since 2000 only 13 CEA/CUA/CBA studies have been conducted in chronic pain. The limited number of economic studies is surprising in light of the significant burden chronic pain places on society. Therefore, further economic research in chronic pain is needed. In addition to conducting additional economic evaluations of pain interventions in various chronic pain conditions (i.e. not only in back pain), it would be beneficial to conduct studies that identify modifiable health behaviours that individuals with chronic pain can perform to ameliorate the effects of chronic pain. Accordingly, Chapter 3 in this thesis provides an analysis that identifies modifiable health influencing activities that are positively associated with improving health status in chronic migraineurs.

Additionally, a study of WTP for improvements in PRM is needed to quantify the burden associated with being in the chronic pain health state. Such a study would also elucidate patient preferences for attributes of pain relief thereby highlighting the specific aspects of pain relief that have the greatest potential for improving health related quality of life. Accordingly, Chapter 4 provides a study of WTP for improvements in PRM.

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CHAPTER 3: HEALTH PRODUCTION FUNCTION OF CHRONIC MIGRAINE

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3.1 INTRODUCTION

The prevalence of migraine in Canada has been estimated at 2.6 million adult females and 0.8 million adult males[1] and affects all ages lasting from infancy to old age.[2] The associated direct and indirect costs are significant. It has been estimated that health care costs for persons with migraine are 1.6 times higher than those without the condition.[3] Migraineurs consume medical health care resources through medical consultations, emergency department visits and treatment.[4-6] Migraine peaks in individuals during the most productive years of life.[7] Consequently, lost productivity due to migraine has been estimated to exceed $17 billion annually in the United States [8;9] and accounts for 7 million annual lost working days in Canada.[10]

The long-term management of migraine is challenging because of its complex etiology and the variable effectiveness of currently available treatment.[11;12] In addition, persons with migraine use personal resources which may potentially improve (as in the case of physical activity)[13;14] or worsen (in the case of cigarette smoking)[15] the migraineurs' health status. Determining how migraineurs manage their condition from the viewpoint of resources utilization (including both medical and personal resources) may provide insights that could lead to more effective care strategies. Furthermore, personal health – related activities supported by medical care resources are a highly effective means of managing conditions such as migraine. Modifiable personal activities are therefore critical components in the successful management of migraine.

The objective of the study was to identify and measure the association between modifiable health – influencing activities (i.e. personal activities in combination with health resources) (MHIA) and changes in health status to determine the relative importance of MHIA for migraineurs and learn how migraineurs can combine MHIA with medical health care services to improve their health status.

3.2 METHODS

3.2.1 Source of Data

The 2000/1 Canadian Community Health Survey cycle 1.1 (CCHS 1.1) is a population based health survey conducted by Statistics Canada as part of a federal initiative to provide health status and health resources utilization data. Specific details of the CCHS 1.1 have been published elsewhere.[16] The CCHS 1.1 employed a multi-stage stratified clustered sampling strategy. Data collection was conducted over 12 months beginning in September 2000 with the sample of households allocated randomly over the 12-month period. The survey questionnaire was administered to a randomly selected household member by a trained interviewer either in person or through telephone.

The CCHS 1.1 sample is representative of approximately 98% of the Canadian population aged 12 years or older in all provinces and territories (with the exception of Indian reserves, Canadian military bases and particular remote areas). It provides information for each person in the sample on personal characteristics, health status, personal health behaviours, and the utilization of health care services.

The CCHS 1.1 Share file is a subset of the master file that contains respondents who agreed to share information with provincial health ministries. The share file contains full information on all variables collected in the CCHS including bootstrap weights.[16] It contains 125,574 respondents.

3.2.2 Study Sample

The target population was all persons older than 19 years who responded to the question concerning self-reported change in health over the previous year: "Compared to

1 year ago, how would you say your health is now? Is it: much better than 1 year ago, somewhat better than 1 year ago, about the same, somewhat worse than 1 year ago or much worse than 1 year ago." There were 109,788 respondents (87%) meeting this criterion.

3.2.3 Statistical Analysis

The Health Production Function (HPF) is a theoretical construct used in health economic research[17;18] to guide empirical investigation of the relationship between resources and health outcomes. It regards the individual as a producer of his/her own health. Using this construct the study conceptualized health status change as a function of explanatory variables which represented resources used by the respondents in the production of health while also controlling for variables that might increase or decrease his or her capacity for good health. Indicators of resources use included health behaviours (i.e. health-influencing personal resources) and health care utilization (i.e. medical care resources). Background control variables include demographics and health status information.

A linear regression model was used to predict self-reported change in health status over the previous year. Changes in health states were ranked from 1 (much worse) to 5 (much better). To realize this model as a linear regression analysis and to properly capture the relationship between MHIA and changes in health status required that the model: 1) controlled for background variables and relevant interactions between these variables; and 2) compared the effects of health influencing behaviours on health status between migraineurs and non-migraineurs (i.e. general population).

Personal health behaviours variables known to be related to migraine included: cigarette consumption,[4;19] alcohol consumption[20] and physical activity.[13;14] Cigarette consumption was dichotomized to compare current smokers [1] to non-smokers [0]. Alcohol dependence was based on the Composite International Diagnostic Interview Short Form for Alcohol Dependence. A predicted probability of 85% was used to indicate alcohol dependence. Physical activity, which was categorized as active, moderate and inactive was included as a continuous variable. Levels of physical activity were derived in the CCHS 1.1 by first, calculating the energy expenditure of specific activities (includes sports, leisure, gardening, and social activities) expressed as kilocalories expended (per kilogram of body weight per hour) per day for survey respondents, and second by adding together their energy cost over all activities. Accordingly, inactive activity describes daily energy expenditures attributable to physical activities of 0-1.5 kcal/kg while moderate and active levels of activity describe daily energy expenditures of 1.5-2.9 and ≥ 3.0 kcal/kg respectively. A linear relationship between physical activity and the dependent variable was discovered. Physical activity was therefore treated as a continuous variable.

Variables which represented resources use of healthcare services included medical and alternative health care services. Medical health care utilization variables included visits to a family physician, visits to a specialist physician and whether or not the person was hospitalized in the past year (for any reason). Number of visits to family and specialist physicians was derived by asking the respondent the number of times they had come in contact with a family or specialist physician over the past year. The alternative health care utilization variable was whether the individual visited [1] or did not visit [0] an alternative health care provider. Alternative care providers were identified in the survey as being acupuncturists, homeopaths, or massage therapists. Data on hospitalization in the last year was included as a no [0] and yes [1] category. Approximately 65% of data on the use of pain medications was missing from the target population and therefore this variable was not included in the final analysis.

Explanatory control variables included socio-demographic variables and co-morbidities. Migraine is known to be prevalent between the ages of 30 to 40 years [7], more common and severe in women,[1;21;22] and is associated with educational attainment.[23] Therefore socio-demographic variables were respondent's age, sex and education. Men and women were coded as [0] and [1] respectively. Education is hypothesized to reflect one's ability to use resources more effectively and was categorized as less than a high school, high school graduate, some post secondary, or post secondary graduate in the CCHS 1.1. Education was recoded into three dummy variables indicating high school graduate versus less than high school, some post secondary versus less than high school, and post secondary graduate versus less than high school. Furthermore, the model included the interaction between sex and age, and sex and education, in the model.

The absence [0] or presence [1] of migraine was included in the model to quantify differential effects between migraineurs and non-migraineurs. The absence [0] or presence [1] of specific chronic conditions was also included to control for co-morbidities commonly associated with migraine. These included cardiovascular conditions (heart disease or high blood pressure)[19;24] and allergies.[24] Moreover, migraine has features common with episodic (i.e. occurrence of self-limited attacks of pain) and chronic pain disorders (i.e. have an enduring predisposition to pain)[25] and is also commonly associated with depression.[26-28] Therefore the presence of musculoskeletal pain (arthritis, fibromyalgia, or back pain) and depression were included in the regression model. With the exception of depression, included chronic conditions were indicated in the CCHS 1.1 by self report via the question "We are interested in conditions diagnosed by a health professional. Do you have 'condition'?" Indications of depression were based on the Composite International Diagnostic Interview Short Form for Major Depression (CIDI-SFMD). Depression on the CIDI-SFMD corresponds to symptomatic depression according to the Diagnostic and Statistical Manual of Mental Disorders Version III criteria. A 90% predicted probability on the CIDI-SFMD indicates the presence of depression.[29] In order to determine whether the presence of migraine changed the nature of the relationships for MHIA and health care utilization variables, two way interactions between migraine and all explanatory variables were included, and a three way interaction between migraine, age and sex was also included in the model.

The analysis employed weighting to correct estimates for the effects of the complex survey design. Specifically sampling weights were rescaled to the total actual sample size; a frequently suggested form of analysis.[30] Statistical significance was determined for estimated parameters by using bootstrap generated standard errors.[16] Model coefficients were considered statistically significant at $p<.05$. SPSS for Windows release 13.0 (SPSS, Chicago Illinois) was used for all statistical analyses.

3.3 RESULTS

3.3.1 Descriptive Statistics

The analysis was conducted both by excluding cases with missing data on independent variables and by including missing cases as dummy variables. The results did not change. The analysis excluding missing data is presented. There were 98,530 respondents (90% of target population) with complete data. Table 3-1 shows the characteristics of the target sample population and migraine population within the target sample. The prevalence of migraine in the sample was 9.7%.

Compared to one year ago, a greater proportion of migraineurs reported better health status than the general target sample population with approximately the same proportion reporting worse health status. A greater proportion of migraineurs were current smokers and there was approximately the same proportion of respondents who were alcohol dependent or physically inactive.

Over the year, migraineurs had more visits to family and specialist physicians, and a greater proportion visited an alternative care provider or was hospitalized. Musculoskeletal pain, cardiovascular conditions, and allergies were more prevalent in the migraine population.

Table 3-1 Characteristics of Study Populations (presented as % unless otherwise indicated)

Variable	Target Sample [a]	Migraine Sample [b]
Change in Health Status Over Previous Year		
Much Better	1.6	8.2
Somewhat Better	10.0	12.5
Same	71.1	62.1
Somewhat Worse	10.8	13.6
Much Worse	6.5	3.6
Demographic Variables		
Age (mean ± SD)	45.9 ± 16.5	42.3 ± 13.6
Female Sex	52.7	74.1
Education		
Less than High School	21.6	21.4
High School Graduate	19.9	20.4
Some Post Secondary	8.3	9.2
Post Secondary Graduate	50.2	49.1
Health Behaviour Variables		
Cigarette Consumption		
Current Smoker	27.0	32.0
Alcohol Dependent	1.7	1.7
Physical Activity Index		
Inactive	56.4	57.4
Moderate	23.5	23.6
Active	20.1	19.1
Health Care Resource Use		
Family Physician Visits (mean ± SD)	3.5 ± 6.4	5.4 ± 6.4
Specialist Visits (mean ± SD)	1.0 ± 4.1	1.4 ± 2.6
Visited an Alternative Care Provider	12.2	18.8
Hospitalized During Previous Year	8.5	12.4
Chronic Conditions		
Migraine	9.7	100
Depression	7.5	17.5
Musculoskeletal Pain	31.2	48.1
Cardiovascular Condition	17.5	18.1
Allergic Condition	29.0	45.1

Note. Observations weighted by relative weights, sums equal sample size (n = 98,530)

[a] Sample with all complete observations.

[b] Characteristics of migraine sample within target sample (n = 9.7% × 98,530).

3.3.2 Linear Regression Model

Of the control variables, age (β = -0.003) and the presence of a musculoskeletal condition (β = -0.08) was associated with a negative health change while female sex (β = 0.058) and being a high school graduate (β = 0.017) was associated with positive health change (*p value* <.05). Table 3-2 shows the regression results for non-control variables and model interactions. Of the modifiable health behavioural factors, smoking was associated with a negative health change while physical activity was associated with a positive health change (*p value* <.05).

Of the health care utilization variables, physician visits were associated with a negative health change while having visited an alternative care provider was associated with a positive health change (*p value* < .05). Of the migraine interactions, age was associated with a negative health change while being a post secondary graduate was associated with a positive health change (*p value* < .05).

Table 3-2 Independent Variable Coefficients

Variable	Coefficient
Background Variables	
Age	-0.003*
Sex (ref men)	0.058*
High School Graduate	0.037*
Some Post Secondary	0.024
Post Secondary Graduate	0.016
Chronic Conditions	
Migraine Condition (ref none)	0.207
Muskuloskeletal Condition (ref none)	-0.080*
Cardiovascular Condition (ref none)	-0.015
Allergic Condition (ref none)	0.016
Depression (ref none)	-0.008
Health Behaviour Variables	
Current Smoker (ref non-smoker)	-0.022*
Alcohol Dependent (ref no)	0.002
Physical Activity	0.084*
Health Care Utilization	
Family Physician Visits	-0.005*
Specialist Physician Visits	0.003
Visited an Alternative Health Care Provider (ref no)	0.058*
Hospitalized in last Year (ref no)	-0.014
Background Interactions	
Sex × Age	-0.001
Sex × High School Graduate	-0.005
Sex × Some Post Secondary	0.046
Sex × Post Secondary Graduate	0.015
Migraine Interactions	
Migraine × Age	-0.006*
Migraine × Sex	-0.135
Migraine × Age × Sex	0.004
Migraine × High School Graduate	0.014
Migraine × Some Post Secondary	0.049
Migraine × Post Secondary Graduate	0.083*
Migraine × Family Physician Visits	-0.002
Migraine × Specialist Physician Visits	0.002
Migraine × Hospitalized in Last Year	-0.044
Migraine × Smoking	0.001
Migraine × Alcohol Dependent	-0.068
Migraine × Physical Activity	0.024
Migraine × Muskuloskeletal Condition	-0.036
Migraine × Cardiovascular Condition	-0.116*
Migraine × Allergic Condition	0.033
Migraine × Depression	-0.061
Constant	3.217*

Dependent Variable: Self Reported Health Status Change over 1 year

$R^2 = 0.04$ n = 98,530

* Indicates $p < .05$ Statistical significance determined by using bootstrap generated standard errors.

3.4 DISCUSSION

The objective of the study was to determine the relative importance of MHIA for migraineurs by measuring the association between MHIA and changes in health status over a one year period. This was tested by including the interactions between having migraine and all other factors in the model while also controlling for the relationships between health status change and age, sex, education, and associated co-morbidities (in their full functional forms including interactions). There were complex functional forms and interactions among the control variables which offer reassurance that the statistical control was effective.

There were a small number of interactions involving migraineurs. Notably, migraineurs who were older were more likely than non-migraineurs to report positive health change. Also, the most highly educated migraine sufferers were more likely to report positive health change. In terms of the MHIA, smoking was associated with negative health change while physical activity was very strongly associated with positive health change. These relationships occurred for all individuals including those with migraine indicating that MHIA do not have differential affects in migraineurs compared to non-migraineurs.

Thus, MHIA are equally important for persons with or without migraine. Previous research on the topic focused on migraineurs alone. This research showed that while intense exercise can be a trigger for migraine,[13;14;21;31] there is evidence suggesting that regular moderate aerobic exercise improves cardiovascular fitness and helps reduce migraine frequency, severity and duration,[13;14] Smoking moreover, is a well known risk factor for migraine.[15;19] The results are new and important because they compare migraineurs with the general population in terms of their abilities to use the resources at their disposal to "produce" health. This is so despite the fact that the variation in health status is greater for migraineurs, as shown in Table 3-2.

3.4.1 Clinical Implications

Furthermore, interpretation of the results provides relevant insights for migraine when viewed in the light of both non-controllable and controllable health behavioural factors. For instance, consider a migraineur with the following characteristics: male, 46 years of age, high school graduate, not alcohol dependent, visited a family physician once, visited a specialist physician once, did not visit an alternative care provider, was not hospitalized, and who does not have any identified co-morbidities. During the year if this individual smoked daily and was physically inactive, he would have a reported health change of 3.1 (no change). However, if instead the individual did not smoke and was physically active his reported health change would be 3.4. Thus, by modifying controllable health behaviours the reported health status of migraineurs can improve. It should be noticed that statistically significant findings are not necessarily clinically important for all patients.[32] A change in health status from 3.1 to 3.4 indicates that if one in three migraineurs stopped smoking and became physically active, this would result in total, in a 1 unit improvement in health status. Thus, from a population perspective these results are significant in magnitude, especially when considering the prevalence of migraine.

3.4.2 Strengths and Limitations

A major strength of the analysis is that it is based on a national, population health survey. Accordingly, the results can be taken as being representative of the entire adult migraine population. In addition, population health surveys contain information on the use of personal health resources (smoking, physical activity, use of alcohol) as well as on the use of medical health care services. The results are therefore based on the self-reported health status of the adult migraine population and their reported behaviors under actual (non-experimental) everyday conditions. For policy – making purposes, it is important to know the health behavior and outcomes of persons with migraine under everyday conditions. Furthermore, while many of the variables included in the model are known to be associated with migraine independently, to the knowledge there has been no research that has combined these variables from a perspective that explicitly views health status as a function of MHIA.

There are however limitations to the approach. Firstly, it is acknowledged that the CCHS 1.1 was a cross sectional survey and therefore precludes any causal inferences. Nonetheless, while the study cannot verify that MHIA caused the changes in health status, an association between MHIA and health status does exist and the findings are consistent with relevant research.[13-15;19] Still, only a prospective longitudinal study would be able to elucidate the causal relationship between modifiable health influencing activities and changes in health status over time.

Secondly, the dependent variable change in health status over a year, is affected by the subjectivity of self reported data[33;34] and is a five category outcome measure which has been treated as a continuous variable. Still, there is plenty of psychometric evidence that Likert scales with at least five categories provide adequate approximation to interval level data[35] and providing the ordinal measure is of high quality, the analysis will produce the same conclusions as using other more appropriate statistical approaches.[36;37] Furthermore, relevant research on the topic has indicated that using parametric analysis on ordinal Likert data do not significantly affect Type I or Type II errors[38] or the robustness of the estimated parameter coefficients.[39;40] Furthermore, there is no outcome measure available on a population basis that is continuous and that measures changes in health status over time.

Thirdly, the indicator variables for formal health care utilization were included in the model as exogenous variables. However, the nature of the health care utilization variables introduces potential for endogeneity because it is uncertain whether individuals who have lower/higher health status access formal healthcare services more frequently or whether individuals who access healthcare services more frequently have lower/higher health status. Endogeneity can cause biased regression coefficients but does not affect statistical efficiency.[41] Circumventing issues of endogeneity are problematic due to the difficulty in identifying suitable instrumental variables and if present, it is often addressed simply by excluding the endogenous variable from the regression model. However, the objective of the study was to specifically explore the impact of modifiable personal health variables in the context of healthcare service utilization, and it was critical that the model control for formal health care utilization variables. Therefore in a separate sensitivity analysis, each formal health care utilization variable was systematically removed from the model to determine their effect on the regression coefficients in the model. It was found that even after removing each formal health care utilization variable, the regression coefficients did not change sign, had very similar magnitudes and thus, did not affect study conclusions.

Fourthly, 71.1% of the sample reported no change in health status over the year. Therefore, given that the dependent variable was change in health status over time, the degree of variance explained by the model was limited because only 29.9% experienced a change in health status. In light of this limitation however, the model fit (R^2) of 4% is comparable to other similar studies.[42] The model is also indicative of the factors that influence health change in those who experienced a change in their health status. Furthermore, although chronic conditions such as migraine last for years, there are few indicators on the health status change which are even one – year in duration.

Lastly, it is unknown whether migraine was diagnosed with standardized diagnostic criteria because it was identified in the CCHS 1.1 by asking respondents whether migraine had been diagnosed by a health professional. Still, the prevalence estimate of 9.7% is similar to another Canadian population based estimate of 8% which suggests that the definition of migraine was reliable.[43]

3.5 CONCLUSION

In conclusion, the results suggest that MHIA are as effective for persons with or without migraine; they also identify the relative importance of specific MHIA. Smoking cessation and increased physical activity in particular, are shown to be effective in improving health status when controlling for health service utilization and background health factors.

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CHAPTER 4: STATED PREFERENCE VALUATION FOR IMPROVEMENTS IN PAIN RELATED MORBIDITY

4.1 INTRODUCTION

Internationally, the prevalence of chronic pain has been estimated to range from 2% to 40% with a median point prevalence of 15%.[1] In the United States, over 50 million individuals are affected from chronic pain,[2] while in Canada, chronic pain affects 27% of men and 31% of women with 80% being moderate or severe in severity.[3] Not surprisingly, pain has been listed as the most common reason for seeking medical care,[4] which translates into significant health care resource use in the form of medical consultations, emergency department visits and treatment.[5-7] In the United States, the direct medical costs of chronic pain was estimated to be at least US$5 billion per year. However, the societal burden of chronic pain is not limited to the healthcare system, but its effects are widespread affecting many sectors of society including employment and productivity.

Chronic pain affects all ages often peaking during the most productive years of life[8] and with estimates as high as 93 million work days lost per year,[9] is listed as a leading cause of lost work days in the United States.[4;10;11] Consequently, the estimated cost of lost productivity attributed to chronic pain is more than US$50 billion per year[4] with a total annual impact on the United States economy of between US$85 and US$95 billion.[12] Still, the physical and psychological affects of chronic pain are not easily quantified,[13] and the full economic burden attributable to chronic pain is underestimated because little information has been collected about the intangible cost of chronic pain (i.e. economic burden of pain and suffering) .

The prevalence of chronic pain is only expected to increase as a result of both the escalating demographic shift in the elderly population, and the rising incidence of musculoskeletal pain conditions.[14] Therefore, the development of more effective treatment and management strategies will become increasingly important to ameliorate the escalating demand for already stretched and scarce health care resources.

Pain related morbidity (PRM) is comprised of both pain intensity and pain related disability (PRD).[1] Determining patient preferences in terms of willingness to pay (WTP) for levels of improvement to pain intensity and/or PRD would provide insights that would lead to more effective pain management strategies because it would elucidate the relative value of improving pain intensity and/or PRD for persons with chronic pain. Obtaining the WTP for improvements in PRM also quantifies the economic burden (i.e. intangible cost of pain and suffering) of chronic pain itself. Accordingly, the objective of the study was to identify chronic pain patients' preferences for levels of improvement in PRM by measuring their WTP for reducing pain intensity and/or improving PRD.

4.2 METHODS

4.2.1 Population and Setting

The study was a cross sectional non-randomized study design. The study took place at the University of Alberta Multidisciplinary Pain Centre. Hours of operation were Monday to Thursday from 8am to 4:30pm. Patients attending the centre are referred by their primary care physician. Newly referred patients undergo a triage and evaluation process by a pain specialist to identify inappropriate referrals (i.e. severity and complexity of chronic pain condition can be managed through primary care physician). Patients whose referral is deemed appropriate are either placed on a waiting list or expedited if clinically appropriate. Participants provided information regarding their WTP for improvements in pain related morbidity (PRM), pain related health status (PRHS), health related quality of life measured by the EQ-5D (including the EQ-5D-

VAS), and background demographics. The inclusion/exclusion criteria for study participation were as follows:

Inclusion Criteria:

1) Diagnosed with a chronic pain condition.

2) Older than 19 years of age.

Exclusion Criteria:

1) Newly referred patient. Newly referred patients were excluded from the study to increase homogeneity in clinical severity of the study population.

2) Involved in legal litigation or an insurance claim. These patients were excluded to eliminate potential bias caused by strategic behaviour.

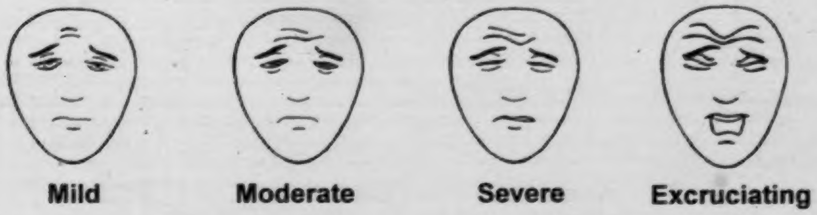
4.2.2 Pain Related Health Status

Self reported PRHS was determined by using standardized clinical measures including the Facial Pain Scale[15] and the Pain Disability Index (see Appendix 4-A).[16-18] Both measures were modified to facilitate comprehension based on information generated from pilot testing. During pilot testing, it was determined that qualitative descriptive rankings used in combination with graphical illustrations improved respondent understanding of the various severities of pain intensity and PRD. The use of visual aids in stated preference valuation techniques is also supported by published research.[19] Figure 4-1 shows the final instruments used for assessing pain intensity and pain related disability. Pain intensity ranged between mild, moderate, severe and excruciating pain. Pain related disability ranged between mild, moderate, severe and total disability. It is important to note that during pilot testing, no participants presented with no pain or no disability and therefore participants with no pain or no disability were not expected given the severity of chronic pain in the patient population.

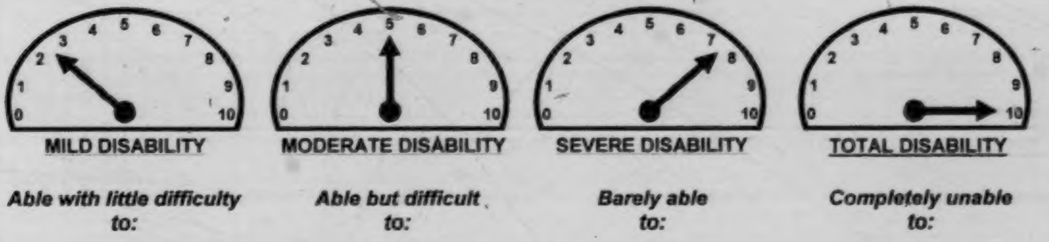
Based on these levels of pain intensity and disability, participants were classified into one of 13 health states: 1) Total Disability and Extreme Pain (TDEP); 2) Total Disability and Severe Pain (TDSP); 3) Total Disability and Moderate Pain (TDMP); 4) Total Disability and Mild Pain (TDMiP); 5) Severe Disability and Extreme Pain (SDEP); 6) Severe Disability and Moderate pain (SDMP); 7) Severe Disability and Mild Pain (SDMiP); 8) Moderate Disability and Extreme Pain (MDEP); 9) Moderate Disability and Moderate Pain (MDMP); 10) Moderate Disability and Mild Pain (MDMiP); 11) Mild Disability and Extreme Pain (MiDEP); 12) Mild Disability and Moderate Pain (MiDMP); and 13) Mild Disability and Mild Pain (MiDMiP).

Figure 4-1 Instruments used for assessing Pain Intensity and Pain Related Disability

PAIN INTENSITY VISUAL GUIDE


Mild
Moderate
Severe
Excruciating

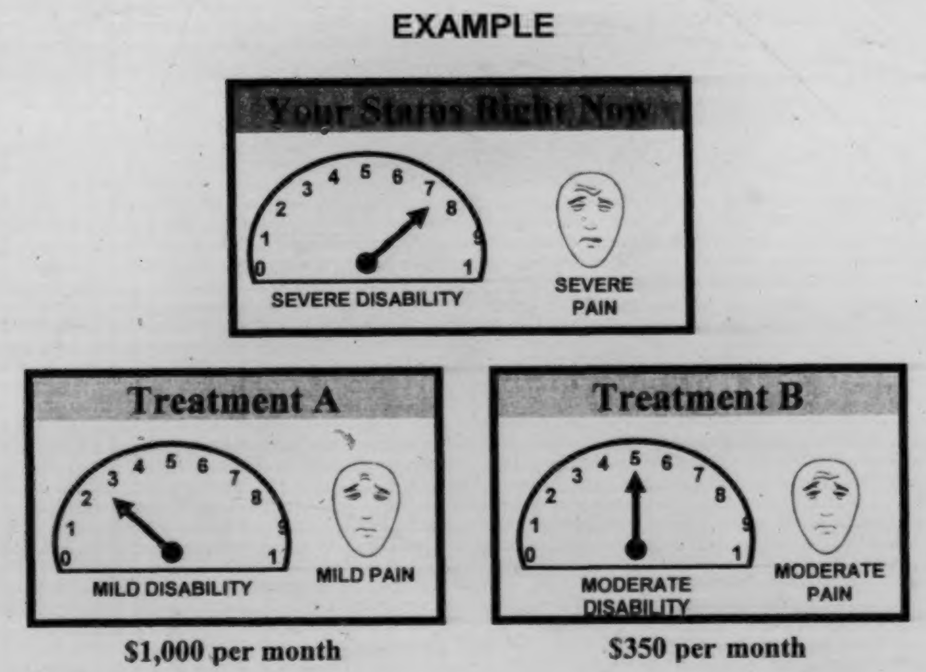
PAIN DISABILITY VISUAL METER


0
1
2
3
4
5
6
7
8
9
10
MILD DISABILITY
MODERATE DISABILITY
SEVERE DISABILITY
TOTAL DISABILITY
Able with little difficulty to:
Able but difficult to:
Barely able to:
Completely unable to:

- Conduct family or home activities (example: chores, preparing meals, family outings).
- Participate in recreation such as leisure, sports, or hobbies.
- Socialize with friends (example: parties, movies, dining).
- Work, keep employed, or volunteer.
- Care for yourself in basic tasks (example: bathing, getting dressed, and eating).

Instruments were adapted from the Facial Pain Scale[15] and the Pain Disability Index[16;18] based on information generated from pilot testing.

Figure 4-2 Example choice question for an individual presenting with Severe Disability and Severe Pain Intensity


EXAMPLE
Your Status Right Now
0 1 2 3 4 5 6 7 8 9 1
SEVERE DISABILITY
SEVERE PAIN
Treatment A
0 1 2 3 4 5 6 7 8 9 1
MILD DISABILITY
MILD PAIN
Treatment B
0 1 2 3 4 5 6 7 8 9 1
MODERATE DISABILITY
MODERATE PAIN
$1,000 per month
$350 per month

4.2.3 WTP Questionnaire

WTP was elicited from a set of discrete choice experiments (DCE).[20-23] The development and design of the WTP questionnaire is summarized in Appendix 4-B. WTP for improving PRM represents the economic burden attributable to the chronic pain state because it denotes the monetary amount an individual is willing to trade to minimize their PRM. In other words, the trade-off between money and health provides a valuation of the morbidity caused by chronic pain. Hence, to obtain an unbiased measure that only represented the burden of chronic pain required measuring WTP independent of treatment modality or other treatment factors (e.g. mode of administration, side-effects, duration of improvement, etc). Therefore, the DCE measured the WTP for treatments that improved pain intensity and/or PRD keeping all other treatment aspects identical.

Participants were presented with a series of choice scenarios, where they could buy one of two hypothetical treatments that differed in three attributes: level of improvement in pain intensity, level of improvement in PRD and monthly out of pocket price. In each choice question, levels of improvement to pain intensity and PRD were represented by graphical illustrations that replicated the categories used for measuring PRHS described above (figure 4-2). Furthermore, the levels of improvements were dependent on the individual's PRHS. For example, for individuals presenting with MDSP, the DCE measured the WTP for treatments that improved upon moderate disability and reduced their severe pain. Thus, a different WTP survey was given to individuals presenting with the following health states: TDEP, TDSP, TDMP, SDEP, SDSP, SDMP, MDEP and MDSP (see Appendix 4-C). WTP was not assessed in individuals presenting with other health states (described above) because no individuals presented with moderate pain intensity and disability, nor were there individuals that presented with mild pain intensity or disability during pilot testing. Pilot testing also revealed that including levels of "no pain" or "no disability" in the surveys compromised realism (e.g. higher proportion stated that treatments were unrealistic) and were therefore removed from the surveys.

The out of pocket prices for each treatment ranged between $100 and $1,000 per month with better treatments associated with a higher price. Price ranges were piloted on a sub-sample of the patient population to ensure that the price range sufficiently captured WTP. It was important to identify an appropriate choke price to ensure the welfare measures captured WTP for pain relief. The upper bound (i.e. choke price) was defined as having approximately 80% (Dr. Wiktor Adamowicz, personal communication, INTD565 course, winter term 2006) of participants rejecting the treatment that cost $1,000 per month.

4.2.4 Other Data

The EQ-5D was used to provide a measure of preference based HRQL (see Appendix 4-D). Health states within the EQ-5D are defined by a classification system that includes five structurally independent attributes (or health dimensions) of health status. These attributes include mobility, self-care, usual activities, pain or discomfort, and anxiety or depression. EQ-5D provides descriptive health status score ranging from -0.59 to 1.00.[24] A score of 0.0 represents death and a score of 1.0 represents perfect health. The minimally important clinical difference for the EQ-5D has been reported as low as 0.074.[24] Scoring function for the EQ-5D was derived from American based preferences.[25] The EQ-5D-VAS (100 points) was also used to measure individual self reported health status. EQ-5D-VAS differs from the EQ-5D in that it represents a subjective (i.e. self reported) valuation of overall health status between 0 (death) and 100 (perfect health).

A background questionnaire was also included to collect information on demographics, clinical history, and debriefing questions concerning the WTP survey (see Appendix 4-E). Demographic information included marital status, smoking status, level of education, income, and other chronic conditions (e.g. diabetes). Debriefing questions included questions that targeted protest bias, consequentiality (i.e. was survey realistic and did individuals make trade-offs seriously), ease of survey, certainty in buying treatments, and the importance of treatment attributes. Information concerning clinical history included number of years with pain. Furthermore, clinical information concerning primary pain diagnosis, date of admittance, date of birth, involvement in legal litigation or insurance claim was obtained from medical charts.

4.2.5 Procedure

The study received ethical approval from the Health Research Ethics Board Panel B (File#B-100106). PRHS, EQ-5D, WTP and background questionnaires were administered through in-person interview. Each day a schedule of appointments were obtained from which four individuals were randomly selected (using a random number generator) to participate in the study. Individuals were provided background information regarding the objective of the study including the purpose and description of each questionnaire (i.e. PRHS, EQ-5D, WTP, and background questionnaire).

After obtaining informed consent (see Appendix 4-F), PRHS was assessed using the questionnaire shown in figure 1. Participants were asked to indicate which of the illustrations best characterized their level of pain intensity and secondly, to what degree their pain affected their ability to conduct family activities, recreation, socialization, employment and self-care. The EQ-5D was then administered followed by the WTP questionnaire.

Based on an individual's PRHS, a corresponding set of choice questions was loaded on a laptop computer screen. Refer to Appendix 4-G for WTP interviewer instructions and response form. While showing an example question on the screen, the participant was told that he/she would be presented with a series of treatments where he/she could buy either treatment A, B or neither treatment. He/she was told that treatments A and B differed in the level of improvement to their pain intensity, level of improvement to their pain related disability, and out of pocket cost per month after insurance. He/she was told that all other aspects of the treatment were identical (i.e. side effects, duration and mode of administration). This was followed by a cheap talk script[26] that explained that although the choices were hypothetical, to treat each choice seriously and to pretend that their choice was binding (i.e. would have to pay the price associated with the treatment chosen). Previous research has shown that cheap talk employed in choice experiments improve consequentiality and validity of WTP estimates.[26]

Participants were given three practice questions before starting the WTP questionnaire. While completing the questionnaire participants could refer to figure 1 at any time. Because each choice question is treated independently from each other, a blank screen was presented for two seconds between each choice question to eliminate the afterimage of the previous choice question.

After the individual completed the WTP questionnaire, the background and debriefing questionnaire was given. The entire assessment including obtaining consent and administering questionnaires took approximately 20 minutes to complete. Data were collected over a six month period beginning in September 2006.

4.2.6 Statistical Analysis

A linear additive model assumes that each attribute has an independent and linear effect on preferences.[23] Analysis of the DCE data was performed assuming a linear additive model in two nested multinomial logistic regression models (described below). The analysis was conducted separately for each version of the WTP questionnaire (i.e. for each presenting pain related health state) but also for a data set that pooled the WTP data across individual health states.

Each coefficient in the models represent the marginal effects of each attribute (amount of satisfaction gained from consuming one additional unit of that attribute).The coefficients from the models were therefore used to achieve 2 aims: 1) the WTP for changes in improvements in PRM. This was achieved by estimating the marginal rate of substitution between the marginal effects of attributes with the marginal effect on cost (i.e. money); and 2) Overall WTP to completely minimize PRM hence providing an estimate of the economic burden of chronic pain.

STATA 9.1 (Statacorp LP, College Station, Texas) was used for all statistical analyses except for the mixed logit models (ML). The ML models were conducted using STATA 10.0 (Statacorp LP, College Station, Texas). Model coefficients were considered statistically significant at $p < .05$. Power calculations were conducted to determine required sample sizes for each DCE version (see Appendix 4-I). Model fit was assessed using pseudo-R-squared (see Appendix 4-H).

Base Model

The base model explored WTP for levels of improvement in PRM excluding demographic and clinical variables for model and variable coding structure. The base model provided mean WTP estimates for levels of improvements in the attributes in the

WTP survey. Attribute levels for pain intensity and pain related disability were dummy coded using no change as the reference category. Price of treatments was entered as a continuous variable. Alternative specific constants for treatments A and B and the neither option were also included in the models. Adding constants for treatments A and B and the neither option controlled for preferential differences between treatment A, B and staying in their current pain related health state irrespective of the treatment attributes (i.e. pain relief, disability improvement and cost).

Base Model + Exogenous Variables

The second model added demographic and clinical variables to the base model. WTP may vary with attributes of treatment as well as characteristics of the patient[27] and this model provided individual specific WTP estimates by demographic and clinical factors. That is, the model explored WTP by the observable heterogeneity in the study population. Incorporating demographic and clinical variables in the regression model required creating interaction terms between the dummy variables of the survey attributes (i.e. levels of improvement in PRD and pain intensity) with demographic and clinical variables. Categorical demographic and clinical variables were effects coded.[28;29]

Chronic pain is associated with older age, more common in women, and is affected by family dynamics.[30-36] Chronic Pain is also known to be associated with educational attainment and lower socio-economic status.[1;35] Therefore demographic variables included age (continuous), gender (1–women, -1–men), marital status (1–married/common-law, -1–single/separated/divorce), education (1–completed post-secondary, -1–did not complete post-secondary), total household income (-1– <$30,000, 0– $30,000-$59,999, 1– >$59,999), and number of household dependents (continuous).

Smoking status has also been shown to be associated with chronic pain[5;32;37] and was included in the model (1– smoker, -1–non-smoker). Furthermore, although ethnicity has been shown to be related to chronic pain,[38] all respondents were Caucasian and therefore this variable was not included in the analysis.

Preference for pain relief was hypothesized to be affected by length of time as a patient, number of years living with chronic pain, and total number of co-morbidities. Psychological distress and depression are known to be associated with chronic pain.[35;39;40] Therefore clinical variables included months as a patient (continuous), number of years with chronic pain (continuous), total number of comorbidities (continuous), and presence of depression (1-yes, -1–no).

4.2.7 Validity and Sensitivity Analysis

Four approaches were employed to increase the validity of the WTP findings. First, tests for consistency and transitivity were incorporated into the WTP questionnaire (Appendix 4-J summarizes methodological issues and their remedies).[41] This determined the extent of embedding effects (i.e. bias resulting from the sequence of questions or because treatment alternatives are presented in isolation of other available alternatives) and identified whether survey respondents were choosing treatments in a manner consistent with making compensatory trade-offs between treatment attributes.

Second, content validity was formally tested in the nested multinomial logistic regression model to verify that WTP was positively associated with higher income. Content validity was further tested by verifying that self reported preferences for survey attributes were positively associated with higher WTP. For example, WTP for pain reduction should be higher than the WTP for disability improvement for individuals who indicated that reducing pain is more important than improving disability. This was conducted in separate multinomial logistic regression models that added self reported preferences to the base + exogenous model (base + exogenous + endogenous).

Third, a sensitivity analysis was conducted to determine whether protest bias, consequentiality and uncertainty affected the WTP estimates. This was conducted by comparing the WTP between individuals who indicated or did not indicate protest bias, lack of consequentiality (i.e. choice was binding), survey difficulty and purchase uncertainty in the base model. Protest bias was defined as individuals who indicated they did not agree with paying for treatments. Lack of consequentiality was defined as indicating the following responses: improvements were good and knew didn't have to pay for treatments; didn't believe level of improvement, or treatments were unrealistic. Uncertainty was defined as individuals who indicated they strongly agree or agree with the statement that they were certain of they would pay the price of the treatments chosen in the survey.

Fourth, to determine whether the demographic, clinical and background variables included in the models adequately captured the heterogeneity in respondent preferences, a ML regression was conducted on the base + exogenous models. This provided information that elucidated the extent to which unobservable heterogeneity (i.e. factors not captured in the study) contributed to WTP.

ML models can estimate any random utility model.[42] Mixed logits are called mixed because the choice probability is a mixture of logits whose probabilities are integrals of standard logit probabilities over a number of paremeters.[43;44] ML relaxes the assumption that the stochastic component of the model is independent and identical distribution and separates the stochastic component into two parts. The first part being a random term with zero mean whose distribution (can take many forms including triangular, normal, log-normal, gamma, etc.) is dependent on underlying parameters in the observed data, and the second, being the random term with zero mean that is independent and identically distributed and does not depend on underlying data.[44]

Therefore, ML can express the lack of knowledge (i.e. unobservable heterogeneity) about how preferences differ by incorporating distributions (i.e. random parameter representation of preference heterogeneity) for specific model parameters. The output from a ML model provide a standard deviation coefficient for parameters specified as random and statistical significance of the standard deviation coefficient indicates the presence of unobserved heterogeneity in a sampled population.[28;44]

4.3 RESULTS

4.3.1 Descriptive Statistics

Table 4-1 shows the characteristics of the sample population (refer to Appendix K for a list of anecdotal comments). There were a total of seventy eight study participants. Participants presented with one of four health states: SDEP (n = 15), SDSP (n = 24), MDEP (n = 3) and MDSP (n = 36). The average age was approximately 48 years with the majority being women, married/common-law, non-smokers, completed post secondary education, and had total annual household incomes $60,000 or greater. Health status was rated similarly by the EQ-5D and EQ-5D-VAS. Over 50% of participants were being treated for back pain and migraine with 37% of participants having depression. The average length of time with chronic pain was 8 years and participants had been attending the pain clinic for an average of 28 months. The proportion of respondents rejecting treatments that cost $1,000 per month was 75%, 78%, 80% and 85% for respondents presenting with SDEP, SDSP, MDEP and MDSP respectively.

Table 4-1 Characteristics of Study Population (presented as %)

Variable	SDEP	SDSP	MDEP	MDSP	All
Sample Size	15	24	3	36	78
Demographics					
Age (M ± SD)	48.6 ± 14.8	46.7 ± 11.9	47.6 ± 21.3	47.6 ± 18.9	47.5 ± 16.0
Female Sex	33.3	58.3	66.7	58.3	53.8
Married/Commonlaw	46.7	66.7	66.7	61.1	60.3
Current Smoker	46.7	45.8	0	38.9	41
Completed Post Secondary Education	60.0	50.0	66.7	50.0	52.6
Total Annual household Income					
Less than $30,000	20.0	20.8	66.7	22.2	23.1
$30,000 – $59,999	40.0	33.3	0	41.7	37.2
Greater than $59,999	40.0	45.8	33.3	36.1	39.7
Overall Health Status					
EQ-5D-Index Score (M ± SD)	0.31 ± 0.21	0.34 ± 0.20	0.30 ± 0.09	0.57 ± 0.17	0.44 ± 0.22
Visual Analogue Scale (M ± SD)	28.6 ± 21.9	31.4 ± 16.9	31.7 ± 20.2	50.3 ± 16.0	39.6 ± 19.9
Pain History					
Number of Years with Pain (M ± SD)	7.7 ± 4.5	7.1 ± 5.8	23.7 ± 37.5	7.5 ± 6.4	7.9 ± 8.9
Months as a Patient (M ± SD)	34.5 ± 21.8	30.1 ± 44.2	17.4 ± 22.8	23.4 ± 18.5	27.4 ± 29.4
Pain Condition and Depression					
Abdominal	0	4.2	0	5.6	3.8
High Back	6.7	12.5	0	0	5.1
Low Back	53.3	25.0	33.3	36.1	35.9
Limb or Joint	13.3	20.8	0	22.2	19.2
Chest	6.7	0	0	2.8	2.6
Headache or Migraine	13.3	16.7	66.7	8.3	14.1
Neuropathic	0	0	0	5.6	2.6
Neuralgia	6.7	8.3	0	5.6	6.4
Other Pain	0	12.5	0	13.9	10.3
Depression	66.7	33.3	33.3	41.7	37.2
WTP Survey Validity Checks					
Improvement unrealistic/unbelievable	8.3	0	0	10	3.6
Certain would buy treatments chosen	80.0	83.3	66.7	63.9	73.1
Survey was easy to understand	73.3	79.2	66.7	66.7	71.8
Trade-offs easy to make	46.7	66.7	66.7	55.6	57.7
Failed Consistency Check	0	0	0	0	0
Failed Transitivity Check	6.7	8.3	0	5.6	6.4
Indicated survey was Consequential	80.0	83.3	66.7	72.2	76.9
Indicated Protest Bias	6.7	0	33.3	8.3	6.4
% Rejecting $1000 Treatment	75%	78%	80%	85%	—

4.3.2 Base Model

Table 4-2 shows the DCE results of the base models (refer to Appendix L for full model results). Note that data for individuals presenting with MDEP was pooled with individuals presented with MDSP because there were only three individuals who presented with MDEP. The coefficient for the alternative specific constant for the neither option was negative but was not statistically significant and therefore removed from the models. The positive coefficient for improvements to PRD and pain intensity indicates that individuals preferred improvements to their PRM. The negative coefficient on price indicated that individuals preferred treatments that cost less. The magnitude of the coefficients indicate that individuals preferred and had a higher WTP for greater improvements in both PRD and pain intensity. Furthermore, respondents preferred pain reduction over improvements in PRD.

Table 4-2 WTP for Improvement in Pain Related Morbidity

Presenting Pain Related Health Status [a]	Price Coefficient β$	WTP ($) For Improvement in Pain Related Morbidity (WTP = -βi / βprice)				
		Disability Improved To		Pain Improved To		
		Moderate	Mild	Severe	Moderate	Mild
SDEP n = 15	-0.0034	-.56/β$ = 161	-.89/β$ = 258	-.85/β$ = 248	-2.6/β$ = 750	-4.1/β$ = 1196
MDEP + SDEP n = 36	-0.0033	-.57/β$ =175	-.84/β$ = 258	-.83/β$ =255	-2.4/β$ =744	-3.8/β$ =1183
SDSP n = 24	-0.0026	b	-.79/β$ = 299	c	-.1.7/β$ = 633	-2.9/β$ = 1088
MDSP n = 36	-0.0025	c	-.96/β$ = 382	c	-1.5/β$ = 608	-2.3/β$ = 900
Pooled [d] n = 78	-0.0026	-.54/β$ = 209	-.93/β$ = 361	-.56/β$ = 225	-1.8/β$ = 681	-2.7/β$ = 1067

Note. WTP is calculated for coefficients that were statistically significant at $p < .05$.
a. A separate nested multinomial regression model was conducted for each PRHS.
b. Coefficient for moderate disability improvement was not statistically significant.
c. Not applicable because there is no improvement upon the presenting health state.
d. Data Combining SDEP, MDEP, SDSP and MDSP.

The base model demonstrates that respondents presenting with SDEP were WTP $161 per month for a reduction to moderate disability, $258 per month for a reduction to mild disability, $248 per month for a reduction to severe pain, $750 per month for a reduction to moderate pain and $1,196 per month for a reduction to mild pain. The marginal WTP for a treatment that reduced both disability and pain intensity to a mild severity (greatest improvement in PRM) was $1,454 per month ($248 + $1196).

Respondents presenting with SDSP were WTP $299 per month for a reduction to mild disability, $633 per month for a reduction to moderate pain and $1,088 per month for a reduction to mild pain. The marginal WTP for a treatment that reduced both disability and pain intensity to a mild severity was $1,387 per month ($299 + $1,088).

Respondents presenting with MDSP were WTP $382 per month for a reduction to mild disability, $608 per month for a reduction to moderate pain and $900 per month for a reduction to mild pain. The marginal WTP for a treatment that reduced both disability and pain intensity to a mild severity was $1,282 per month ($382 + $900).

Respondents presenting with MDEP or SDEP were WTP $175 per month for a reduction to moderate disability, $258 per month for a reduction to mild disability, $255 per month for a reduction to severe pain, $744 per month for a reduction to moderate pain and $1,183 per month for improvements to mild pain. The marginal WTP for a treatment that reduced both disability and pain intensity to a mild severity was $1,441 per month ($258 + $1,183).

Pooling across health states indicate that overall, respondents were WTP $209 per month for a reduction to moderate disability, $361 per month for a reduction to mild disability, $225 per month for a reduction to severe pain, $681 for a reduction to moderate pain and $1,067 per month for a reduction to mild pain. The marginal WTP for a treatment that reduced both disability and pain intensity to a mild severity was $1,428 per month ($361 + $1,067).

4.3.3 Base + Exogenous Model

Tables 4-3 through 4-5 show the DCE results of base + exogenous models (refer to Appendix M for full model results) which examines the role of demographic and clinical variables on WTP values. The coefficient for the alternative specific constant of the neither option was negative but was not statistically significant and therefore removed from the models. For respondents presenting with SDEP (table 3), older age, men, being a smoker, higher family income, time as a patient, number of years with pain, number of comorbidities and not having depression were associated with higher WTP for reductions in pain intensity. Higher family income and time as a patient were associated with higher WTP for improvements in PRD. For respondents with MDEP or SDEP (table 3), older age, being a smoker and higher family income were associated with a higher WTP for reductions in pain intensity. Older age was also associated with higher WTP for improvements in PRD.

For respondents presenting with SDSP (table 4), older age, being a non-smoker, higher family income, and not having depression were associated with higher WTP for reductions in pain intensity. Time as a patient was associated with a lower WTP for reductions in pain intensity. Being a non-smoker, higher family income, time as a patient, and being depressed was associated with a higher WTP for improvements in PRD. Number of years with pain was associated with a lower WTP for improvements in PRD. For respondents with MDSP, age, higher family income and not being depressed was associated with higher WTP for reductions in pain intensity. Being married/commonlaw, time as a patient, number of years with pain and not being depressed was associated with higher WTP for improvements in PRD. Time as a patient was associated with a lower WTP for reductions in pain intensity and for improvements to PRD.

When pooling across all presenting PRHS (table 5), younger age, men, higher income and not being depressed with associated with higher WTP for reductions in pain intensity. Time as a patient was associated with a lower WTP for reductions in pain intensity. Being married/commonlaw, being a non-smoker, higher income and not being depressed was associated with higher WTP for improvements in PRD.

Table 4-3 WTP for Improvement in Pain Related Morbidity by Demographic and Clinical Factors for Individuals Presenting with SDEP or MDEP pooled with SDEP

Demographic and Clinical Variables	WTP ($) For Improvement in Pain Related Morbidity				
	Disability Improved To		Pain Improved To		
	Moderate	Mild	Severe	Moderate	Mild
SDEP					
Age (per additional year) ref = 49				$38	$56
Women (ref)				$396	
Men				$942	
Smoker (ref)				$396	
Non-Smoker				$400	
< 30k (ref)		$58			$500
30k – 59k		-$42			na
>59k		-$362			$1,742
Time at clinic (per added month) ref = 35	$2		$10	$8	$8
Years with Pain (per added year)			$89		
# of comorbidities (per added condition) ref = 3				$277	$442
Not Depressed (ref)				$396	$500
Depressed				-$354	-$219
MDEP + SDEP					
Age (per added year) ref = 49	$2				-$50
Smoker (ref)			$248		
Non-Smoker			-$184		
< 30k (ref)				$207	$332
>59k				$864	$1,415
# of comorbidities (per added condition) ref = 3				$289	$368

Note. Blank cells indicate that coefficient for attribute was not statistically significant at $p < .05$. Changes in WTP by demographic and clinical variables are calculated from the reference case.

Table 4-4 WTP for Improvement in Pain Related Morbidity by Demographic and Clinical Factors for Individuals Presenting with SDSP or MDSP

Demographic and Clinical Variables	WTP ($) For Improvement in Pain Related Morbidity				
	Disability Improved To		Pain Improved To		
	Moderate	Mild	Severe	Moderate	Mild
SDSP					
Age (per additional year) ref = 47					$11
Smoker (ref)	-$270				-$5
Non-Smoker	$81				$427
< 30k (ref)		-$103			-$5
30k - 59k		$284			$1,084
>59k					$1,143
Time as a patient (per added month) ref = 30		$5		-$3	
Years with Pain (per added year) ref = 7		-$8			
Not Depressed (ref)		-$103			-$5
Depressed		-$82			-$438
MDSP					
Age (per added year) ref = 48				$3	
Not Married/Commonlaw (ref)		-$283			
Married/Commonlaw		$1,148			
< 30k (ref)					$776
>59k					$1,393
Time as a patient (per added month) ref = 23		-$10		-$10	
Years with Pain (per added year) ref = 7		$28			
Not Depressed (ref)		$255			$779
Depressed		-$186			$386

Note. Blank cells indicate that coefficient for attribute was not statistically significant at $p < .05$. Changes in WTP by demographic and clinical variables are calculated from the reference case.

Table 4-5 WTP for Improvement in Pain Related Morbidity by Demographic and Clinical Factors Pooled Across all Health States

Demographic and Clinical Variables	WTP ($) For Improvement in Pain Related Morbidity				
	Disability Improved To		Pain Improved To		
	Moderate	Mild	Severe	Moderate	Mild
Pooled [a]					
Age (per added year) ref = 48					-$11
Women (ref)			$428		$310
Men			$55		$503
Not Married/Commonlaw (ref)		-$48			
Married/Commonlaw		$228			
Smoker (ref)	-$148		$428		
Non-Smoker	$100		-$48		
< 30k (ref)		-$48		$248	$310
30k - 59k		$217			
>59k				$734	$1,076
Time as a patient (per added month) ref = 27				-$3	
Not Depressed (ref)		-$48			$310
Depressed		-$221			$110

Note. Blank cells indicate that coefficient for attribute was not statistically significant at $p < .05$.
Changes in WTP by demographic and clinical variables are calculated from the reference case.
a. Data Combining SDEP, MDEP, SDSP and MDSP.

4.3.4 Validity and Sensitivity Analysis

100% and 93.6 % passed the consistency and transitivity checks respectively. In the base models, the pseudo-R-squared values ranged from 0.2 to 0.4. In the base + exogenous models, the pseudo-R-squared values ranged from 0.4 to 0.9. Marginal effects in the base and base + exogenous models were statistically significant and the pain and disability attributes had the expected sign (+,-) and magnitude. Income was positively associated with higher WTP for improvements in both pain intensity and PRD. WTP was positively associated with reported preferences for treatment attributes (e.g. had a higher WTP for pain reduction and indicated that pain reduction was an extremely important attribute in choosing between treatments. See Appendix 4-N). There were statistically significant differences in WTP between respondents who indicated or did not indicate protest bias, lack of consequentiality or purchase uncertainty (See Appendix 4-O). Respondents who indicated protest bias, consequentiality or purchase certainty had a higher WTP for improvements in PRM.

Table 4-6 show the results from the ML model (see Appendix 4-P for complete model results). The standard deviation coefficient was not statistically significant at p<.05 for improvements in PRM but was statistically significant for price. Thus, there is unobserved heterogeneity for price but not for preferences for improvements in PRM.

Table 4-6 Mixed Logit Model for Improvement in Pain Related Morbidity

Attributes	Mean parameter coefficient		SD parameter coefficient	
	Value	SE	Value	SE
Disability Improvement				
Reduced To Mild	1.053*	0.329	0.109	0.138
Reduced To Moderate	1.399*	0.608	0.094	0.123
Pain Improvement				
Reduced To Mild	3.472*	0.387	0.215	0.188
Reduced To Moderate	2.020*	0.7263	0.905	0.473
Reduced To Severe	1.568	1.369	0.910	0.504
Price	-0.003*	0.0002	0.0004*	0.0002

* p < .05

4.4 DISCUSSION

4.4.1 General

The societal impact of chronic pain is significant and should be of great concern to policy makers because of the rising prevalence and escalating burden on scarce healthcare resources. To provide insight that may lead to more effective pain management strategies and to quantify the economic burden of the chronic pain state, the study measured the WTP for reducing pain intensity or improving PRD for persons with chronic pain. The results indicate that persons with chronic pain are WTP significant amounts to minimize their PRM.

The base model showed that overall (i.e. pooled results), persons with chronic pain are WTP \$361 and \$1,067 per month to improve PRD and reduce pain intensity to a mild severity respectively. However, WTP was lower in respondents who indicated they were certain of their treatment choices and in respondents who indicated their choices were consequential. There is evidence that WTP estimates generated from certain and consequential responses more accurately reflect WTP.[45] Therefore, it may be more accurate to conclude that monthly WTP ranges between \$92 and \$361 to reduce disability to a mild severity, and between \$440 and \$1,067 to reduce pain intensity to a mild severity. Therefore, the sample population was WTP \$453 to \$1,428 per month to completely minimize PRM (i.e. PRM reduce to a mild severity) translating to approximately \$5,500 to \$17,000 per year. Furthermore, the average gross annual family income of the sample population (calculated by using the mid point in income categories as a point estimate) was \$33,000 suggesting that persons with chronic pain are willing to allocate between 19% and 52% of their gross family income to minimize the morbidity caused by chronic pain.

The results also indicate that persons with chronic pain strongly prefer pain reduction over disability improvement. Regardless of presenting severity in disability, for every dollar an individual was WTP to improve their disability to the lowest severity (mild), he/she was WTP approximately $2 to reduce pain intensity to moderate and approximately $3 to reduce pain intensity to mild. This suggests that treatment and management strategies that target pain intensity over improvements in disability would have the greatest impact on improving health related quality of life for persons with chronic pain.

4.4.2 Strengths and Limitations

There are several strengths to the analysis that increase the validity of the findings. Firstly, tests for consistency and transitivity confirm that the large majority of respondents were not using heuristics nor were embedding effects an issue.

Secondly, WTP was positively associated with higher income and with self reported preferences for attributes of pain reduction indicating that the results were consistent with underlying theory. Construct validity was further evidenced by the fact that model coefficients were statistically significant, had the expected sign (+,-), and that the association between WTP and demographic/clinical variables were consistent with a priori hypotheses and existing published research. Thirdly, the proportion of respondents rejecting treatments that cost $1,000 per month was 75%, 78%, 80% and 85% for respondents presenting with SDEP, SDSP, MDEP and MDSP respectively which indicates that the bid range adequately captured WTP.

Lastly, the ML results indicate that unobserved heterogeneity is not present for preferences for levels of improvement in PRM and therefore a single parameter estimate was representative of the sample population (i.e. population was homogenous). This provides face validity that the instruments used to assess PRHS was effective in appropriately differentiating levels of severity in the sample population.

The results however should be considered in light of study limitations. Firstly, The ML results indicate there is unobserved preference heterogeneity for price indicating a single parameter estimate is not representative of all individuals in the sample population. Therefore there are other factors affecting price that was not adequately captured in the study.

Secondly, previous research has suggested that capturing and explaining sources of heterogeneity may be informative for decision makers because it would not only inform the distributional effects of policy decisions but allow for predictive models which could forecast potential policy impacts.[46] Hence, while the models explore the degree of unobserved heterogeneity, explaining their sources remain to be resolved by future research.

Thirdly, it is not certain that the WTP estimates reflect what would have been observed in a real market, although real markets for the types of treatments available for the severity of the patient population do not exist in a publicly funded health care system. Research suggests that estimating WTP from respondents who are certain of their choices approximate real market values.[45] WTP to minimize PRM was approximately $900 per month ($1067 + $361 - $92 + $440) lower in respondents who were certain of their choices.

Fourthly, WTP for improvements in PRM is influenced by factors such as efficacy, safety, time to relief, side-effects and duration of effect.[14;47] However, the objective of the study was to obtain a measure that represented the burden of chronic pain itself, independent of treatment modality or other treatment factors. Therefore, the WTP for improvements in PRM in light of other treatment factors remains to be resolved by future research.

Fifthly, the study only measured WTP for treatments that improved PRM to a mild severity because including treatments that completely removed PRM compromised realism which threatened the validity of the estimates. Therefore, the estimate of economic burden only reflects the economic burden associated with minimizing (opposed to eliminating) the affects of chronic pain.

Sixthly, in the base + exogenous models, marital status (i.e. family dynamics), income, months as a patient, number of years with chronic pain, total number of comorbidities and depression may be endogenous although they were treated as exogenous variables. However it is important to reiterate that the coefficients for these variables were consistent with a priori hypotheses and existing published research.

Lastly, WTP is likely dependent on the clinical context and severity of health status in the sample population. The severity of chronic pain in the study population was not representative of the severity in 'typical' chronic pain sufferers who can be managed through their primary care physician. It is also important to note that the average gross family income of the study population was lower than that of the general Canadian population. Therefore, the results can only be generalized to persons with chronic pain whose severity necessitates care beyond those offered by primary care and those with lower income.

4.4.3 Clinical Implications

The preference for reducing pain intensity over PRD is a cause for concern because despite there being treatments known to reduce pain intensity, there is a large proportion of individuals who are undiagnosed and untreated.[4;14] Although substantial healthcare resources are directed at chronic pain many barriers to appropriate pain management exist.[48;49] One barrier is the inconsistency between what patients expect from their clinician and what is in fact received in terms of care and treatment.[4] This may be partly explained by a study that found that physicians treating chronic pain often lack confidence in their ability to provide effective treatment.[48]

However, the study also found that physicians who had received pain education were more likely to choose effective treatment options and were positive about prognosis.[48] Thus, educating physicians about chronic pain and the effectiveness of available treatments should be part of any strategy that aims to provide better chronic pain management. The results support a re-focusing on reducing pain intensity in spite of most pain management strategies focusing on the acceptance of pain and the pursuit of normal life activities.[50]

Interestingly there are opioids available that are known to effectively reduce pain intensity but their use remains controversial due to issues surrounding abuse, dependency[4] and potential adverse events. Consequently clinicians will need to trade off risks with what chronic patients prefer, which was found above all else, is a reduction in pain intensity. It would be prudent to conduct future research (similar to this study) that measures patient preferences in the context of risk, safety and uncertainty. Results from such a study would elucidate the trade off between risks and benefits from a patient perspective and hence provide insight for developing clinical guidelines around the use of potentially harmful treatments with known effectiveness.

4.4.4 Policy Implications

Two main policy implications emerge from this study. First, the results provide support for increased investment in pain management centers given their potential for significant returns on investment. For example, consider a pain centre with approximately 5,000 patients per year. If only 50% of patients in the center benefited from a therapy and of those, if only 50% had improvements to mild levels of pain intensity and disability that totalled 6 months of relief, the revenue generated from these individuals would still range between $7 (2500 × $532× 6) and $21 million (2500 × $1,428×6) per year. If the annual operating budget of a pain centre is approximately 3 million (including labour, supplies, equipment and facilities costs), the return on investment is between $4 and $18 million per year. In other words, for every patient enrolled in the centre, the return on investment is potentially between $800 and $3,600 per patient per year.

Secondly, the results provide practical insights for the insurance and legal systems because there has been limited guidance around the appropriate level of compensation for health effects (i.e. pain and disability). It has been argued that using WTP to inform compensation issues may in fact lead to fairer and more systematic system of settling awards.[51] The question faced by the insurance and legal systems is "what value should be placed on life or loss in quality of life?" This naturally leads to issues of whether the appropriate value of compensation is the monetary amount required to make the individual as well off *before* the loss in their quality of life (i.e. willingness to accept (WTA)), or as well off *after* the loss in quality of life (i.e. WTP).

Distinguishing between WTA and WTP is critical for informing fair and appropriate compensation because studies have repeatedly shown that WTA is much greater than WTP.[52-54] However, it can be argued that because quality of life (QoL) was in possession before the exposure that caused the loss, and because QoL is a unique "good" without readily available substitutes (i.e. cannot be replaced), the appropriate measure of compensation for pain and suffering is WTA.

Therefore, in light of WTA being greater than WTP the results can be considered the minimum level of compensation required to compensate the effects of pain and disability. For example, consider an individual who is injured and has a pain related health status of SDEP. The level of compensation should be at least $1,454 per month. It is important to recognize that this is the minimum amount of compensation for the health effect only, as additional compensation is required for other aspects including emotional distress and loss employment. Therefore, $1,454 is the amount in addition to the amounts required to compensate the individual for other aspects such as emotional distress and loss employment.

4.5 CONCLUSION

The economic burden associated with pain and suffering is significant. This study shows that persons with chronic pain are ready to allocate up to half of their total annual family income to minimize their pain and suffering. Treatment and management strategies that focus on reducing pain intensity would have the greatest impact on improving health related quality of life. Future research in pain valuation should focus on the tradeoff between treatment risk and benefits from a patient perspective to provide guidance around the use of potentially harmful treatments with know effectiveness.

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CHAPTER 5: THESIS CONCLUSIONS

5.1 THESIS RATIONALE AND RESEARCH PURPOSE

Economic analyses are critical components to inform policies and strategies aimed at improving chronic pain and ameliorating the detrimental effects to societal resources. Measuring the cost-effectiveness of treatment and management strategies are important to ameliorate the escalating demand for constrained health care resources because it provides guidance regarding the allocative distribution of health care resources to decision makers.

Still, even the most effective and cost-effective interventions will not significantly ameliorate the societal burden of chronic pain unless individuals with chronic pain also bear responsibility for properly managing their chronic pain. Thus, identifying modifiable health behaviours, in the context of formal health care service utilization, that persons with chronic pain can adopt to improve their quality of life is not only critical to providing a diverse management approach, but may also provide insights that lead to more effective care strategies.

If persons with chronic pain bear responsibility for managing their chronic pain, it is essential that treatment and management programs also incorporate their preferences for pain related improvement. Management programs that incorporate patient preferences will have a greater potential for positively impacting health related quality of life. Therefore, measuring patient preferences through WTP will also have a significant contribution.

Economic analyses can therefore offer a significant contribution to research in chronic pain. Three areas of contribution have been outlined above and accordingly, this thesis has three primary objectives. The first objective (Chapter 2) was to conduct a review and synthesis of the evidence surrounding the cost effectiveness of interventions for chronic pain. A review of WTP studies in chronic pain was also included to assess the viability of employing WTP approaches in Chapter 4 of this thesis. The second objective (Chapter 3) was to conduct a health production function for persons with chronic migraine to identify modifiable health influencing activities (in the context of healthcare service utilization) that are positively associated with improving their health status over time. The third objective was to identify chronic pain patients' preferences for levels of improvement in PRM by measuring their WTP for reducing their pain intensity and/or improving their PRD.

5.2 ECONOMIC EVALUATIONS IN CHRONIC PAIN

The objective in Chapter 2 was to review the published literature concerning economic evaluations and WTP studies in chronic pain. More specifically, Chapter 2 sought to address four research questions. The first question was how many full economic evaluations have been conducted in chronic pain? The literature search indicates that between 2000 and 2006 there have been a number of economic evaluations most dealing with interventions in back pain. The majority of cost-effectiveness/utility analyses (CEA/CUA) were based on randomized controlled trial (RCT) data. Nevertheless, it is important to recognize there was a wide variability in the economic quality of the studies. The quality of the studies ranged between 18 and 29 out of 33 possible quality points.

The second question was which interventions for chronic pain have shown evidence of cost-effectiveness? Results from the literature review indicates that there is evidence that lumbar spine radiography (vs. usual care), lumbar fusion (vs. no surgery), spinal manipulation (vs. best care or exercise), self management programs (vs. usual care) and periradicular infiltration (vs. no intervention) are cost-effective interventions for chronic low back pain.

Furthermore, there is evidence that light multidisciplinary treatment for men is cost beneficial compared to usual care. For chronic neck pain, there is evidence that manual therapy is both less costly and more effective than physiotherapy or general practitioner care for chronic neck pain while spinal cord stimulation in combination with physical therapy is cost-effective compared to physical therapy alone for chronic reflex sympathetic dystrophy. Lastly, there is evidence that aerobic and resistance exercise is both less costly and more effective than health education for chronic knee pain.

The third and fourth questions were whether willingness to pay (WTP) had been used in chronic pain and whether WTP is a viable research approach? Results from the literature search indicate that there are very few WTP studies in chronic pain and as a result, the economic burden of the chronic pain state has not been quantified. Therefore, previous estimates of global economic burden of chronic pain are largely underestimated because the economic burden associated with pain related morbidity is unknown. Furthermore, WTP is a viable method for eliciting patient preferences for treatment attributes in chronic pain research. The welfare measures generated from the WTP studies were consistent with a priori hypotheses and theoretical constructs of WTP.

5.3 HEALTH PRODUCTION FUNCTIONS FOR MIGRAINEURS

The objective in Chapter 3 was to conduct a health production function for persons with chronic migraine headaches. More specifically, Chapter 3 sought to address two research questions. The first research question was what is the association between modifiable variables and health status? The analysis indicates that smoking is negatively associated with health status change over one year while physical activity is positively associated with health status change over one year. Furthermore, the relationship between modifiable variables and health status are observed in both migraineurs and non-migraineurs suggesting that modifiable health influencing activities do not have a differential affect in migraineurs compared to non-migraineurs. Therefore, modifiable health influencing activities are equally important for persons with or without migraine.

The second research question was what is the impact of modifiable health influencing activities on health status from a population perspective? The analysis indicates that modifying health influencing activities have a clinically important affect on health status when taken from a population perspective. Three migraineurs who stop smoking and become more physically active can result in a one unit improvement in health status in the migraine population. From a population perspective these results are significant considering the prevalence of migraine.

5.4 WILLINGNESS TO PAY FOR IMPROVEMENTS IN PRM

The objective in Chapter 4 was to measure the WTP for improvements in pain related morbidity in persons with chronic pain. More specifically, Chapter 4 sought to address three research questions. The first question was what are persons with chronic pain WTP for improvements in their pain related morbidity? Results from the choice experiments suggest that persons with chronic pain are WTP $92 to $361 per month out of pocket to improve pain related disability to a mild severity and $440 and $1,067 per month out of pocket to reduce pain intensity to a mild severity. Therefore, persons with chronic pain are WTP $532 to $1,428 per month out of pocket to minimize their pain related morbidity. This amount translates to approximately $6,400 to $17,000 per year (19% to 52% of their gross family income) suggesting that the economic burden associated with pain related morbidity is at least $6,400 to $17,000 per year per person.

The second research question was do persons with chronic pain prefer improvements to pain intensity or pain related morbidity? Persons with chronic pain strongly prefer pain reduction over disability improvement. For every dollar an individual was WTP to improve their disability to the lowest severity (mild), he/she was WTP approximately $2 to reduce pain intensity to moderate and $3 to reduce pain intensity to mild. Thus, treatment and management strategies that target pain intensity over improvements in disability would have the greatest impact on improving health related quality of life.

The third research question was whether WTP differed by demographic and clinical characteristics? For persons presenting with severe disability and extreme pain, WTP is positively associated with older age, men, being a smoker, higher income, longer time as a patient, higher number of years with pain, higher number of comorbidities and not being depressed. For persons presenting with moderate disability and extreme pain or severe disability and extreme pain, WTP is positively associated with older age, being a smoker, higher income and higher number of comorbidities. For persons presenting with severe disability and severe pain, WTP is positively associated with older age, being a non-smoker, higher income, longer time as a patient for disability improvements, more time as a patient for pain reduction, higher number of years with pain and being depressed. For persons with moderate disability and severe pain, WTP is positively associated with older age, being married/commonlaw, higher income, longer time as a patient, higher number of years with pain and not being depressed. When pooling across all presenting health states, WTP is positively associated with older age, women, being married/commonlaw, being a non-smoker, higher income, longer time as a patient and not being depressed.

5.5 FUTURE RESEARCH RECOMMENDATIONS

There are three areas for future research that emerge from this thesis. As outlined in Chapter 2, the limited number of economic studies in chronic pain is surprising in light of the significant burden chronic pain places on society. Therefore, further economic evaluations of chronic pain interventions are needed particularly in areas other than chronic back pain.

From Chapter 3, although smoking cessation and physical activity is positively associated with changes to health status, it is apparent that a longitudinal prospective study is needed to explore the causal relationship between modifiable health influencing activities and changes in health status.

Lastly, in was evident in Chapter 4 that reducing pain intensity would result in the most significantly improvement in health related quality of life. Because the economic burden associated with chronic pain is extremely high, the opportunity cost of not providing effective treatment would be significant. Therefore there needs to be immediate research that measures patient preferences for pain reduction in the context of risk, safety and uncertainty associated with various treatments (e.g. opioids).

A study of trade offs between risks and benefits from a patient perspective would provide insight for developing clinical guidelines around the use of potentially harmful treatments with known effectiveness. Without this type of research, clinicians will continue to be "left in the dark" regarding the level of acceptable risk for prescribing potentially harmful treatments with known effectiveness. Furthermore, preferences for other treatments factors such as mode of administration, side-effects, onset of relief and duration of improvement should also be included with risk, safety and uncertainty.

5.6 RESEARCH CONTRIBUTION

As previously reiterated several times throughout this thesis, economic analyses are critical components to inform policies and strategies aimed at improving chronic pain and ameliorating the detrimental effects to society and escalating demand for already stretched and scarce health care resources. Economic research in chronic pain can provide insights into identifying interventions that are cost-effective which will provide guidance to decision makers regarding allocative decisions of scarce health care resources (Chapter 2). Economic research can also identify how persons with chronic pain can manage their condition from the viewpoint of resource utilization and personal health behaviours which can lead to more effective care strategies (Chapter 3). Economic research can also be used to identify patient preferences for attributes of improvement in PRM while informing the economic value of reducing PRM (Chapter 4).

Therefore this thesis provides a significant contribution to economic research in chronic pain. There has been only one review published examining economic evaluations in chronic pain and Chapter 2 reviews and synthesises current evidence regarding the cost-effectiveness of various interventions for chronic pain, which can inform policy decisions and guide future economic research in the area.

Determining how migraineurs manage their condition from the broader viewpoint of resource utilization in Chapter 3 is important because it not only provides insights that potentially lead to more effective care strategies, but it also examines the combined use of resources *in situ*. There has been no research that has combined modifiable variables from a perspective that views health status as a function of various health inputs (resources) that migraineurs can utilize to affect change.

Lastly, measuring the WTP for improvements in PRM in Chapter 4 are significant because firstly, the economic burden associated with chronic pain has not been quantified resulting in an underestimation of the economic impact of chronic pain. Secondly, it identifies patient preferences for attributes of pain improvement which provides insights to clinicians and other providers of pain services of how to best impact health related quality of life. Thirdly, the government, insurance industry and legal system are involved in compensation issues but there has been limited guidance around the appropriate level of compensation for health effects (i.e. pain and disability). WTP does provide a framework of addressing this issue and may be potentially used to determine the minimum amount of compensation for pain related morbidity. Fourthly, because WTP provides a monetary valuation of pain related morbidity, cost benefit analysis is now possible enabling decision makers to directly compare pain interventions with programs outside of the health sector. This would enable analyses that would identify whether particular interventions produce net benefits to society.

APPENDICES

Numbering for appendices is done by chapter. Note that there are no appendices associated with chapter 1 or chapter 3 and therefore there are no appendices labeled Appendix 1 or Appendix 3.

APPENDIX 2-A: SEARCH STRATEGY

Database	Platform or URL	Date Searched/ Edition	Search Terms
EMBASE	(Ovid – licensed resource)	September 29, 2006	exp PAIN CLINIC/ OR exp PAIN ASSESSMENT/ OR exp CHRONIC PAIN/ OR exp PAIN/ **AND** willingness to pay.mp. or exp "Cost Benefit Analysis"/ OR exp Health Care Policy/ or wtp.mp. OR monetary valuation.mp. OR exp WELFARE/ or welfare.mp. or exp SOCIAL WELFARE/ OR economic$.mp. or exp HEALTH ECONOMICS/ OR exp "COST UTILITY ANALYSIS"/ or utility.mp.OR "COST-EFFECTIVENESS"
PubMed	www.pubmed.gov	September 29, 2006	(pain clinic OR pain assessment OR chronic pain OR pain OR pain management **AND** (willingness to pay OR cost benefit analysis OR cost-effectiveness OR cost utility OR monetary valuation OR welfare OR social welfare OR health economics OR health policy)
PsycINFO	(Ovid – licensed resource)	September 29, 2006	exp PAIN CLINIC/ or exp PAIN ASSESSMENT/ **AND** exp CHRONIC PAIN/ or exp PAIN/ or willingness to pay.mp. or exp "Cost Benefit Analysis"/ or exp Health Care Policy/ or wtp.mp. or monetary valuation.mp. or exp WELFARE/ or welfare.mp. or exp SOCIAL WELFARE/ or economic$.mp. or exp HEALTH ECONOMICS/ or exp "COST UTILITY ANALYSIS"/ or utility.mp. or "COST-EFFECTIVENESS"
ERIC	(Ovid – licensed resource)	September 29, 2006	exp PAIN CLINIC/ or exp PAIN ASSESSMENT/ **AND** exp CHRONIC PAIN/ or exp PAIN/ or willingness to pay.mp. or exp "Cost Benefit Analysis"/ or exp Health Care Policy/ or wtp.mp. or monetary valuation.mp. or exp WELFARE/ or welfare.mp. or exp SOCIAL WELFARE/ or economic$.mp. or exp HEALTH ECONOMICS/ or exp "COST UTILITY ANALYSIS"/ or utility.mp. or "COST-EFFECTIVENESS"
MEDLINE	(Ovid – licensed resource)	September 29, 2006	exp PAIN CLINIC/ or exp PAIN ASSESSMENT/ **AND** exp CHRONIC PAIN/ or exp PAIN/ or willingness to pay.mp. or exp "Cost Benefit Analysis"/ or exp Health Care Policy/ or wtp.mp. or monetary valuation.mp. or exp WELFARE/ or welfare.mp. or exp SOCIAL WELFARE/ or economic$.mp. or exp HEALTH ECONOMICS/ or exp "COST UTILITY ANALYSIS"/ or utility.mp. or "COST-EFFECTIVENESS"
CINAHL	(Ovid – licensed resource)	September 29, 2006	exp PAIN CLINIC/ or exp PAIN ASSESSMENT/ **AND** exp CHRONIC PAIN/ or exp PAIN/ or willingness to pay.mp. or exp "Cost Benefit Analysis"/ or exp Health Care Policy/ or wtp.mp. or monetary valuation.mp. or exp WELFARE/ or welfare.mp. or exp SOCIAL WELFARE/

Database	Platform or URL	Date Searched/ Edition	Search Terms
			or economic$.mp. or exp HEALTH ECONOMICS/ or exp "COST UTILITY ANALYSIS"/ or utility.mp. or "COST-EFFECTIVENESS"
AMED	(Ovid – licensed resource)	September 29, 2006	exp PAIN CLINIC/ or exp PAIN ASSESSMENT/ **AND** exp CHRONIC PAIN/ or exp PAIN/ or willingness to pay.mp. or exp "Cost Benefit Analysis"/ or exp Health Care Policy/ or wtp.mp. or monetary valuation.mp. or exp WELFARE/ or welfare.mp. or exp SOCIAL WELFARE/ or economic$.mp. or exp HEALTH ECONOMICS/ or exp "COST UTILITY ANALYSIS"/ or utility.mp. or "COST-EFFECTIVENESS"
Health and Psychosocial Instruments	(Ovid – licensed resource)	September 29, 2006	exp PAIN CLINIC/ or exp PAIN ASSESSMENT/ **AND** exp CHRONIC PAIN/ or exp PAIN/ or willingness to pay.mp. or exp "Cost Benefit Analysis"/ or exp Health Care Policy/ or wtp.mp. or monetary valuation.mp. or exp WELFARE/ or welfare.mp. or exp SOCIAL WELFARE/ or economic$.mp. or exp HEALTH ECONOMICS/ or exp "COST UTILITY ANALYSIS"/ or utility.mp. or "COST-EFFECTIVENESS"
International Pharmaceutical Abstracts	(Ovid – licensed resource)	September 29, 2006	exp PAIN CLINIC/ or exp PAIN ASSESSMENT/ **AND** exp CHRONIC PAIN/ or exp PAIN/ or willingness to pay.mp. or exp "Cost Benefit Analysis"/ or exp Health Care Policy/ or wtp.mp. or monetary valuation.mp. or exp WELFARE/ or welfare.mp. or exp SOCIAL WELFARE/ or economic$.mp. or exp HEALTH ECONOMICS/ or exp "COST UTILITY ANALYSIS"/ or utility.mp. or "COST-EFFECTIVENESS"
All EBM Reviews: Cochrane, DSR, ACP Journal Club, Dare, CCTR	(Ovid – licensed resource)	September 29, 2006	exp PAIN CLINIC/ or exp PAIN ASSESSMENT/ **AND** exp CHRONIC PAIN/ or exp PAIN/ or willingness to pay.mp. or exp "Cost Benefit Analysis"/ or exp Health Care Policy/ or wtp.mp. or monetary valuation.mp. or exp WELFARE/ or welfare.mp. or exp SOCIAL WELFARE/ or economic$.mp. or exp HEALTH ECONOMICS/ or exp "COST UTILITY ANALYSIS"/ or utility.mp. or "COST-EFFECTIVENESS"
Centre for Reviews and Dissemination [NHS Economic Evaluation Database (NHS EED), and Heath Technology Assessment (HTA)	CRD Databases	September 29, 2006	pain or "chronic pain" or "pain assessment" **AND** "willingness to pay" or WTP or "monetary valuation" OR "cost benefit" or "cost utility" or "economic analysis" or "cost-effective" OR "health policy" or welfare
EconLit	EBSCO	September	pain or "chronic pain" or "pain assessment"

Database	Platform or URL	Date Searched/ Edition	Search Terms
		29, 2006	**AND** "willingness to pay" or WTP or "monetary valuation" OR "cost benefit" or "cost utility" or "economic analysis" or "cost-effective" OR "health policy" or welfare

Notes: The * symbol is a truncation character that retrieves all possible suffix variations of the root word e.g. surg* retrieves surgery, surgical, surgeon, etc. Searches were limited to English
publications on humans between 2000 and 2007.

APPENDIX 2-B: QUALITY ASSESSMENT

Article: Skouen *et al.* (2002)

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1. Was a well-defined question posed in answerable form? – 1 point ☑

1.1 Did the study examine both costs and effects of the service(s) or programme(s)? – 1 point ☑

1.2 Did the study involve a comparison of alternatives? – 1 point ☑

1.3 Was a viewpoint for the analysis stated and was the study placed in any particular decision-making context? – 1 point ☒

Score = 3/4

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2. Was a comprehensive description of the competing alternatives given (i.e. can you tell who did what to whom, where, and how often)? – 1 point ☑

2.1 Were any important alternatives omitted? – 1 point ☑

Score = 2/2

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3. Was the effectiveness of the programmes or services established? – 1 point ☑

3.1 If done through a RCT, did the trial protocol reflect what would happen in regular practice? – 1 point ☒

3.2a Was effectiveness established through an overview of clinical studies? – 1 point ☒

3.2b If observational data or assumptions were used to establish effectiveness did they address potential biases? – 1 point ☒

Score = 1/3

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4. Were all the important and relevant costs and consequences for each alternative identified? – 1 point ☑

4.1 Was the range wide enough for the research question at hand? – 1 point ☑

4.2 Did it cover all relevant viewpoints? (Possible viewpoints include the community or social viewpoint, and those of patients and third-party payers. Other viewpoints may also be relevant depending upon the particular analysis.) – 1 point ☒

4.3 Were capital costs, as well as operating costs, included? – 1 point ☒

Score = 2/4

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5. Were costs and consequences measured accurately in appropriate physical units (e.g. hours of nursing time, number of physician visits, lost work-days, gained life-years)? – 1 point ☒

5.1 Were any of the identified items omitted from measurement? If so, does this mean that they carried no weight in the subsequent analysis? – 1 point ☑

Score = 1/2

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6. Were costs and consequences valued credibly? – 1 point ☑

6.1 Were the sources of all values clearly identified? (Possible sources include market values, patient or client preferences and views, policy-makers' views and health professionals' judgements). – 1 point ☑

6.2a Were market values employed for changes involving resources gained or depleted? – 1 point ☒

6.2b Where market values were absent (e.g. volunteer labour), or market values did not reflect actual values (such as clinic space donated at a reduced rate), were adjustments made to approximate market values? – 1 point ☑

6.3 Was the valuation of consequences appropriate for the question posed (i.e. has the appropriate type or types of analysis – cost-effectiveness, cost-benefit, cost-utility – been selected)? – 1 point ☑

Score = 4/4

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7. Were costs and consequences adjusted for differential timing? – 1 point ☑

7.1 Were costs and consequences which occur in the future 'discounted' to their present values? – 1 point ☑

7.2 Was any justification given for the discount rate used? – 1 point ☑

Score = 3/3

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8. Were the additional (incremental) costs generated by one alternative over another compared to the additional effects, benefits, or utilities generated? – 1 point ☑

Score = 1/1

9. Was allowance made for uncertainty in the estimates of costs and consequences? – 1 point ☒

9.1 If data on costs or consequences were stochastic, were appropriate statistical analyses performed? – 1 point ☒

9.2. If a sensitivity analysis was employed, was justification provided for the ranges of values (for key study parameters)? – 1 point ☒

Score = 0/3

10. Did the presentation and discussion of study results include all issues of concern to users? – 1 point ☒

10.1 Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (e.g. cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion? – 1 point ☑

10.2 Were the results compared with those of others who have investigated the same question? If so, were allowances made for potential differences in study methodology? – 1 point ☒

10.3 Did the study discuss the generalisability of the results to other settings and patient/client groups? – 1 point ☒

10.4 Did the study allude to, or take account of, other important factors in the choice or decision under consideration (e.g. distribution of costs and consequences, or relevant ethical issues)? – 1 point ☒

10.5 Did the study discuss issues of implementation, such as the feasibility of adopting the 'preferred' programme given existing financial or other constraints, and whether any freed resources could be redeployed to other worthwhile programmes? – 1 point ☒

Score = 1/6

Article: Kovacs *et al.* (2002)

1. Was a well-defined question posed in answerable form? – 1 point ☑

1.1 Did the study examine both costs and effects of the service(s) or programme(s)? – 1 point ☑

1.2 Did the study involve a comparison of alternatives? – 1 point ☑

1.3 Was a viewpoint for the analysis stated and was the study placed in any particular decision-making context? – 1 point ☒

Score = 3/4

2. Was a comprehensive description of the competing alternatives given (i.e. can you tell who did what to whom, where, and how often)? – 1 point ☑

2.1 Were any important alternatives omitted? – 1 point ☑

Score = 2/2

3. Was the effectiveness of the programmes or services established? – 1 point ☑

3.1 If done through a RCT, did the trial protocol reflect what would happen in regular practice? – 1 point ☒

3.2a Was effectiveness established through an overview of clinical studies? – 1 point ☑

3.2b If observational data or assumptions were used to establish effectiveness did they address potential biases? – 1 point

Score = 2/3

4. Were all the important and relevant costs and consequences for each alternative identified? – 1 point ☑

4.1 Was the range wide enough for the research question at hand? – 1 point ☑

4.2 Did it cover all relevant viewpoints? (Possible viewpoints include the community or social viewpoint, and those of patients and third-party payers. Other viewpoints may also be relevant depending upon the particular analysis.) – 1 point ☒

4.3 Were capital costs, as well as operating costs, included? – 1 point ☒

Score = 2/4

5. Were costs and consequences measured accurately in appropriate physical units (e.g. hours of nursing time, number of physician visits, lost work-days, gained life-years)? – 1 point ☑

5.1 Were any of the identified items omitted from measurement? If so, does this mean that they carried no weight in the subsequent analysis? – 1 point ☑

Score = 2/2

6. Were costs and consequences valued credibly? – 1 point ☑

6.1 Were the sources of all values clearly identified? (Possible sources include market values, patient or client preferences and views, policy-makers' views and health professionals' judgements). – 1 point ☑

6.2a Were market values employed for changes involving resources gained or depleted? – 1 point ☑

6.2b Where market values were absent (e.g. volunteer labour), or market values did not reflect actual values (such as clinic space donated at a reduced rate), were adjustments made to approximate market values? – 1 point

6.3 Was the valuation of consequences appropriate for the question posed (i.e. has the appropriate type or types of analysis – cost-effectiveness, cost-benefit, cost-utility – been selected)? – 1 point ☑

Score = 4/4

7. Were costs and consequences adjusted for differential timing? – 1 point ☒

7.1 Were costs and consequences which occur in the future 'discounted' to their present values? – 1 point ☒

7.2 Was any justification given for the discount rate used? – 1 point ☒

Score = 0/3

8. Were the additional (incremental) costs generated by one alternative over another compared to the additional effects, benefits, or utilities generated? – 1 point ☑

Score = 1/1

9. Was allowance made for uncertainty in the estimates of costs and consequences? – 1 point ☑

9.1 If data on costs or consequences were stochastic, were appropriate statistical analyses performed? – 1 point ☒

9.2. If a sensitivity analysis was employed, was justification provided for the ranges of values (for key study parameters)? – 1 point ☑

Score = 2/3

10. Did the presentation and discussion of study results include all issues of concern to users? – 1 point ☒

10.1 Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (e.g. cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion? – 1 point ☒

10.2 Were the results compared with those of others who have investigated the same question? If so, were allowances made for potential differences in study methodology? – 1 point ☒

10.3 Did the study discuss the generalisability of the results to other settings and patient/client groups? – 1 point ☒

10.4 Did the study allude to, or take account of, other important factors in the choice or decision under consideration (e.g. distribution of costs and consequences, or relevant ethical issues)? – 1 point ☒

10.5 Did the study discuss issues of implementation, such as the feasibility of adopting the 'preferred' programme given existing financial or other constraints, and whether any freed resources could be redeployed to other worthwhile programmes? – 1 point ☒

Score = 0/6

Article: Miller *et al.* (2002)

1. Was a well-defined question posed in answerable form? – 1 point ☑

1.1 Did the study examine both costs and effects of the service(s) or programme(s)? – 1 point ☑

1.2 Did the study involve a comparison of alternatives? – 1 point ☑

1.3 Was a viewpoint for the analysis stated and was the study placed in any particular decision-making context? – 1 point ☑

Score = 4/4

2. Was a comprehensive description of the competing alternatives given (i.e. can you tell who did what to whom, where, and how often)? – 1 point ☒

2.1 Were any important alternatives omitted (i.e. usual care)? – 1 point ☑

Score = 1/2

3. Was the effectiveness of the programmes or services established? – 1 point ☑

3.1 If done through a RCT, did the trial protocol reflect what would happen in regular practice? – 1 point ☒

3.2a Was effectiveness established through an overview of clinical studies? – 1 point ☑

3.2b If observational data or assumptions were used to establish effectiveness did they address potential biases? – 1 point

Score = 2/3

4. Were all the important and relevant costs and consequences for each alternative identified? – 1 point ☑

4.1 Was the range wide enough for the research question at hand? – 1 point ☑

4.2 Did it cover all relevant viewpoints? (Possible viewpoints include the community or social viewpoint, and those of patients and third-party payers. Other viewpoints may also be relevant depending upon the particular analysis.) – 1 point ☑

4.3 Were capital costs, as well as operating costs, included? – 1 point ☒

Score = 3/4

5. Were costs and consequences measured accurately in appropriate physical units (e.g. hours of nursing time, number of physician visits, lost work-days, gained life-years)? – 1 point ☑

5.1 Were any of the identified items omitted from measurement? If so, does this mean that they carried no weight in the subsequent analysis? – 1 point ☑

Score = 2/2

6. Were costs and consequences valued credibly? – 1 point ☑

6.1 Were the sources of all values clearly identified? (Possible sources include market values, patient or client preferences and views, policy-makers' views and health professionals' judgements). – 1 point ☑

6.2a Were market values employed for changes involving resources gained or depleted? – 1 point ☑

6.2b Where market values were absent (e.g. volunteer labour), or market values did not reflect actual values (such as clinic space donated at a reduced rate), were adjustments made to approximate market values? – 1 point

6.3 Was the valuation of consequences appropriate for the question posed (i.e. has the appropriate type or types of analysis – cost-effectiveness, cost-benefit, cost-utility – been selected)? – 1 point ☑

Score = 4/4

7. Were costs and consequences adjusted for differential timing? – 1 point ☑ unnecessary < 1r horizon

7.1 Were costs and consequences which occur in the future 'discounted' to their present values? – 1 point ☑

7.2 Was any justification given for the discount rate used? – 1 point ☑

Score = 3/3

8. Were the additional (incremental) costs generated by one alternative over another compared to the additional effects, benefits, or utilities generated? – 1 point ☑

Score = 1/1

9. Was allowance made for uncertainty in the estimates of costs and consequences? – 1 point ☑

9.1 If data on costs or consequences were stochastic, were appropriate statistical analyses performed? – 1 point ☑

9.2. If a sensitivity analysis was employed, was justification provided for the ranges of values (for key study parameters)? – 1 point ☑

Score = 3/3

10. Did the presentation and discussion of study results include all issues of concern to users? – 1 point ☒

10.1 Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (e.g. cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion? – 1 point ☑

10.2 Were the results compared with those of others who have investigated the same question? If so, were

allowances made for potential differences in study methodology? – 1 point ☒
10.3 Did the study discuss the generalisability of the results to other settings and patient/client groups? – 1 point ☒
10.4 Did the study allude to, or take account of, other important factors in the choice or decision under consideration (e.g. distribution of costs and consequences, or relevant ethical issues)? – 1 point ☒
10.5 Did the study discuss issues of implementation, such as the feasibility of adopting the 'preferred' programme given existing financial or other constraints, and whether any freed resources could be redeployed to other worthwhile programmes? – 1 point ☒
Score = 1/6

Article: Fritzell *et al.* (2004)

1. Was a well-defined question posed in answerable form? – 1 point ☑
1.1 Did the study examine both costs and effects of the service(s) or programme(s)? – 1 point ☑
1.2 Did the study involve a comparison of alternatives? – 1 point ☑
1.3 Was a viewpoint for the analysis stated and was the study placed in any particular decision-making context? – 1 point ☑
Score = 4/4

2. Was a comprehensive description of the competing alternatives given (i.e. can you tell who did what to whom, where, and how often)? – 1 point ☑
2.1 Were any important alternatives omitted (i.e. usual care)? – 1 point ☑
Score = 2/2

3. Was the effectiveness of the programmes or services established? – 1 point ☑
3.1 If done through a RCT, did the trial protocol reflect what would happen in regular practice? – 1 point ☒
3.2a Was effectiveness established through an overview of clinical studies? – 1 point ☑
3.2b If observational data or assumptions were used to establish effectiveness did they address potential biases? – 1 point
Score = 2/3

4. Were all the important and relevant costs and consequences for each alternative identified? – 1 point ☑
4.1 Was the range wide enough for the research question at hand? – 1 point ☑
4.2 Did it cover all relevant viewpoints? (Possible viewpoints include the community or social viewpoint, and those of patients and third-party payers. Other viewpoints may also be relevant depending upon the particular analysis.) – 1 point ☑
4.3 Were capital costs, as well as operating costs, included? – 1 point ☒
Score = 3/4

5. Were costs and consequences measured accurately in appropriate physical units (e.g. hours of nursing time, number of physician visits, lost work-days, gained life-years)? – 1 point ☑
5.1 Were any of the identified items omitted from measurement? If so, does this mean that they carried no weight in the subsequent analysis? – 1 point ☑
Score = 2/2

6. Were costs and consequences valued credibly? – 1 point ☑
6.1 Were the sources of all values clearly identified? (Possible sources include market values, patient or client preferences and views, policy-makers' views and health professionals' judgements). – 1 point ☑
6.2a Were market values employed for changes involving resources gained or depleted? – 1 point ☑
6.2b Where market values were absent (e.g. volunteer labour), or market values did not reflect actual values (such as clinic space donated at a reduced rate), were adjustments made to approximate market values? – 1 point
6.3 Was the valuation of consequences appropriate for the question posed (i.e. has the appropriate type or types of analysis – cost-effectiveness, cost-benefit, cost-utility – been selected)? – 1 point ☑
Score = 4/4

7. Were costs and consequences adjusted for differential timing? – 1 point ☑

7.1 Were costs and consequences which occur in the future 'discounted' to their present values? – 1 point ☑

7.2 Was any justification given for the discount rate used? – 1 point ☑

Score = 3/3

8. Were the additional (incremental) costs generated by one alternative over another compared to the additional effects, benefits, or utilities generated? – 1 point ☑

Score = 1/1

9. Was allowance made for uncertainty in the estimates of costs and consequences? – 1 point ☑

9.1 If data on costs or consequences were stochastic, were appropriate statistical analyses performed? – 1 point ☑

9.2. If a sensitivity analysis was employed, was justification provided for the ranges of values (for key study parameters)? – 1 point ☑

Score = 3/3

10. Did the presentation and discussion of study results include all issues of concern to users? – 1 point ☑

10.1 Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (e.g. cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion? – 1 point ☑

10.2 Were the results compared with those of others who have investigated the same question? If so, were allowances made for potential differences in study methodology? – 1 point ☑

10.3 Did the study discuss the generalisability of the results to other settings and patient/client groups? – 1 point ☒

10.4 Did the study allude to, or take account of, other important factors in the choice or decision under consideration (e.g. distribution of costs and consequences, or relevant ethical issues)? – 1 point ☑

10.5 Did the study discuss issues of implementation, such as the feasibility of adopting the 'preferred' programme given existing financial or other constraints, and whether any freed resources could be redeployed to other worthwhile programmes? – 1 point ☒

Score = 4/6

Article: UK BEAM Trial Team (2004)

1. Was a well-defined question posed in answerable form? – 1 point ☑

1.1 Did the study examine both costs and effects of the service(s) or programme(s)? – 1 point ☑

1.2 Did the study involve a comparison of alternatives? – 1 point ☑

1.3 Was a viewpoint for the analysis stated and was the study placed in any particular decision-making context? – 1 point ☑

Score = 4/4

2. Was a comprehensive description of the competing alternatives given (i.e. can you tell who did what to whom, where, and how often)? – 1 point ☑

2.1 Were any important alternatives omitted (i.e. usual care)? – 1 point ☑

Score = 2/2

3. Was the effectiveness of the programmes or services established? – 1 point ☑

3.1 If done through a RCT, did the trial protocol reflect what would happen in regular practice? – 1 point ☒

3.2a Was effectiveness established through an overview of clinical studies? – 1 point ☑

3.2b If observational data or assumptions were used to establish effectiveness did they address potential biases? – 1 point

Score = 2/3

4. Were all the important and relevant costs and consequences for each alternative identified? – 1 point ☑

4.1 Was the range wide enough for the research question at hand? – 1 point ☑

4.2 Did it cover all relevant viewpoints? (Possible viewpoints include the community or social viewpoint, and those of patients and third-party payers. Other viewpoints may also be relevant depending upon the particular analysis.) – 1 point ☑

4.3 Were capital costs, as well as operating costs, included? – 1 point ☒
Score = 3/4

5. Were costs and consequences measured accurately in appropriate physical units (e.g. hours of nursing time, number of physician visits, lost work-days, gained life-years)? – 1 point ☑
5.1 Were any of the identified items omitted from measurement? If so, does this mean that they carried no weight in the subsequent analysis? – 1 point ☑
Score = 2/2

6. Were costs and consequences valued credibly? – 1 point ☑
6.1 Were the sources of all values clearly identified? (Possible sources include market values, patient or client preferences and views, policy-makers' views and health professionals' judgements). – 1 point ☑
6.2a Were market values employed for changes involving resources gained or depleted? – 1 point ☑
6.2b Where market values were absent (e.g. volunteer labour), or market values did not reflect actual values (such as clinic space donated at a reduced rate), were adjustments made to approximate market values? – 1 point
6.3 Was the valuation of consequences appropriate for the question posed (i.e. has the appropriate type or types of analysis – cost-effectiveness, cost-benefit, cost-utility – been selected)? – 1 point ☑
Score = 4/4

7. Were costs and consequences adjusted for differential timing? – 1 point ☑
7.1 Were costs and consequences which occur in the future 'discounted' to their present values? – 1 point ☑
7.2 Was any justification given for the discount rate used? – 1 point ☑
Score = 3/3

8. Were the additional (incremental) costs generated by one alternative over another compared to the additional effects, benefits, or utilities generated? – 1 point ☑
Score = 1/1

9. Was allowance made for uncertainty in the estimates of costs and consequences? – 1 point ☑
9.1 If data on costs or consequences were stochastic, were appropriate statistical analyses performed? – 1 point ☑
9.2. If a sensitivity analysis was employed, was justification provided for the ranges of values (for key study parameters)? – 1 point ☑
Score = 3/3

10. Did the presentation and discussion of study results include all issues of concern to users? – 1 point ☑
10.1 Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (e.g. cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion? – 1 point ☑
10.2 Were the results compared with those of others who have investigated the same question? If so, were allowances made for potential differences in study methodology? – 1 point ☒
10.3 Did the study discuss the generalisability of the results to other settings and patient/client groups? – 1 point ☑
10.4 Did the study allude to, or take account of, other important factors in the choice or decision under consideration (e.g. distribution of costs and consequences, or relevant ethical issues)? – 1 point ☑
10.5 Did the study discuss issues of implementation, such as the feasibility of adopting the 'preferred' programme given existing financial or other constraints, and whether any freed resources could be redeployed to other worthwhile programmes? – 1 point ☑
Score = 5/6

Article: Niemisto *et al.* (2005)

1. **Was a well-defined question posed in answerable form?** – 1 point ☑

1.1 Did the study examine both costs and effects of the service(s) or programme(s)? – 1 point ☑

1.2 Did the study involve a comparison of alternatives? – 1 point ☑

1.3 Was a viewpoint for the analysis stated and was the study placed in any particular decision-making context? – 1 point ☑

Score = 4/4

2. **Was a comprehensive description of the competing alternatives given (i.e. can you tell who did what to whom, where, and how often)?** – 1 point ☑

2.1 Were any important alternatives omitted (i.e. usual care)? – 1 point ☑

Score = 2/2

3. **Was the effectiveness of the programmes or services established?** – 1 point ☑

3.1 If done through a RCT, did the trial protocol reflect what would happen in regular practice? – 1 point ☒

3.2a Was effectiveness established through an overview of clinical studies? – 1 point ☑

3.2b If observational data or assumptions were used to establish effectiveness did they address potential biases? – 1 point

Score = 2/3

4. **Were all the important and relevant costs and consequences for each alternative identified?** – 1 point ☑

4.1 Was the range wide enough for the research question at hand? – 1 point ☑

4.2 Did it cover all relevant viewpoints? (Possible viewpoints include the community or social viewpoint, and those of patients and third-party payers. Other viewpoints may also be relevant depending upon the particular analysis.) – 1 point ☑

4.3 Were capital costs, as well as operating costs, included? – 1 point ☒

Score = 3/4

5. **Were costs and consequences measured accurately in appropriate physical units (e.g. hours of nursing time, number of physician visits, lost work-days, gained life-years)?** – 1 point ☑

5.1 Were any of the identified items omitted from measurement? If so, does this mean that they carried no weight in the subsequent analysis? – 1 point ☑

Score = 2/2

6. **Were costs and consequences valued credibly?** – 1 point ☑

6.1 Were the sources of all values clearly identified? (Possible sources include market values, patient or client preferences and views, policy-makers' views and health professionals' judgements). – 1 point ☑

6.2a Were market values employed for changes involving resources gained or depleted? – 1 point ☑

6.2b Where market values were absent (e.g. volunteer labour), or market values did not reflect actual values (such as clinic space donated at a reduced rate), were adjustments made to approximate market values? – 1 point

6.3 Was the valuation of consequences appropriate for the question posed (i.e. has the appropriate type or types of analysis – cost-effectiveness, cost-benefit, cost-utility – been selected)? – 1 point ☑

Score = 4/4

7. **Were costs and consequences adjusted for differential timing?** – 1 point ☒

7.1 Were costs and consequences which occur in the future 'discounted' to their present values? – 1 point ☒

7.2 Was any justification given for the discount rate used? – 1 point ☒

Score = 0/3

8. **Were the additional (incremental) costs generated by one alternative over another compared to the additional effects, benefits, or utilities generated?** – 1 point ☑

Score = 1/1

9. **Was allowance made for uncertainty in the estimates of costs and consequences?** – 1 point ☑

9.1 If data on costs or consequences were stochastic, were appropriate statistical analyses performed? – 1 point ☑

9.2. If a sensitivity analysis was employed, was justification provided for the ranges of values (for key

study parameters)? – 1 point ☑
Score = 3/3

10. Did the presentation and discussion of study results include all issues of concern to users? – 1 point ☑
10.1 Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (e.g. cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion? – 1 point ☑
10.2 Were the results compared with those of others who have investigated the same question? If so, were allowances made for potential differences in study methodology? – 1 point ☑
10.3 Did the study discuss the generalisability of the results to other settings and patient/client groups? – 1 point ☒
10.4 Did the study allude to, or take account of, other important factors in the choice or decision under consideration (e.g. distribution of costs and consequences, or relevant ethical issues)? – 1 point ☒
10.5 Did the study discuss issues of implementation, such as the feasibility of adopting the 'preferred' programme given existing financial or other constraints, and whether any freed resources could be redeployed to other worthwhile programmes? – 1 point ☒
Score = 3/6

Article: Rivero-Aris *et al.* (2006)

1. Was a well-defined question posed in answerable form? – 1 point ☑
1.1 Did the study examine both costs and effects of the service(s) or programme(s)? – 1 point ☑
1.2 Did the study involve a comparison of alternatives? – 1 point ☑
1.3 Was a viewpoint for the analysis stated and was the study placed in any particular decision-making context? – 1 point ☑
Score = 4/4

2. Was a comprehensive description of the competing alternatives given (i.e. can you tell who did what to whom, where, and how often)? – 1 point ☑
2.1 Were any important alternatives omitted (i.e. usual care)? – 1 point ☒
Score = 1/2

3. Was the effectiveness of the programmes or services established? – 1 point ☑
3.1 If done through a RCT, did the trial protocol reflect what would happen in regular practice? – 1 point ☒
3.2a Was effectiveness established through an overview of clinical studies? – 1 point ☑
3.2b If observational data or assumptions were used to establish effectiveness did they address potential biases? – 1 point
Score = 2/3

4. Were all the important and relevant costs and consequences for each alternative identified? – 1 point ☑
4.1 Was the range wide enough for the research question at hand? – 1 point ☑
4.2 Did it cover all relevant viewpoints? (Possible viewpoints include the community or social viewpoint, and those of patients and third-party payers. Other viewpoints may also be relevant depending upon the particular analysis.) – 1 point ☑
4.3 Were capital costs, as well as operating costs, included? – 1 point ☒
Score = 3/4

5. Were costs and consequences measured accurately in appropriate physical units (e.g. hours of nursing time, number of physician visits, lost work-days, gained life-years)? – 1 point ☑
5.1 Were any of the identified items omitted from measurement? If so, does this mean that they carried no weight in the subsequent analysis? – 1 point ☑
Score = 2/2

6. Were costs and consequences valued credibly? – 1 point ☑

6.1 Were the sources of all values clearly identified? (Possible sources include market values, patient or client preferences and views, policy-makers' views and health professionals' judgements). – 1 point ☑

6.2a Were market values employed for changes involving resources gained or depleted? – 1 point ☑

6.2b Where market values were absent (e.g. volunteer labour), or market values did not reflect actual values (such as clinic space donated at a reduced rate), were adjustments made to approximate market values? – 1 point

6.3 Was the valuation of consequences appropriate for the question posed (i.e. has the appropriate type or types of analysis – cost-effectiveness, cost-benefit, cost-utility – been selected)? – 1 point ☑

Score = 4/4

7. Were costs and consequences adjusted for differential timing? – 1 point ☑ unnecessary <1 year horizon

7.1 Were costs and consequences which occur in the future 'discounted' to their present values? – 1 point ☑

7.2 Was any justification given for the discount rate used? – 1 point ☑

Score = 3/3

8. Were the additional (incremental) costs generated by one alternative over another compared to the additional effects, benefits, or utilities generated? – 1 point ☑

Score = 1/1

9. Was allowance made for uncertainty in the estimates of costs and consequences? – 1 point ☑

9.1 If data on costs or consequences were stochastic, were appropriate statistical analyses performed? – 1 point ☒

9.2. If a sensitivity analysis was employed, was justification provided for the ranges of values (for key study parameters)? – 1 point ☑

Score = 2/3

10. Did the presentation and discussion of study results include all issues of concern to users? – 1 point ☒

10.1 Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (e.g. cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion? – 1 point ☒

10.2 Were the results compared with those of others who have investigated the same question? If so, were allowances made for potential differences in study methodology? – 1 point ☑

10.3 Did the study discuss the generalisability of the results to other settings and patient/client groups? – 1 point ☒

10.4 Did the study allude to, or take account of, other important factors in the choice or decision under consideration (e.g. distribution of costs and consequences, or relevant ethical issues)? – 1 point ☒

10.5 Did the study discuss issues of implementation, such as the feasibility of adopting the 'preferred' programme given existing financial or other constraints, and whether any freed resources could be redeployed to other worthwhile programmes? – 1 point ☒

Score = 1/6

Article: Strong *et al.* (2006)

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1. Was a well-defined question posed in answerable form? – 1 point ☑
1.1 Did the study examine both costs and effects of the service(s) or programme(s)? – 1 point ☑
1.2 Did the study involve a comparison of alternatives? – 1 point ☑
1.3 Was a viewpoint for the analysis stated and was the study placed in any particular decision-making context? – 1 point ☑
Score = 4/4

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2. Was a comprehensive description of the competing alternatives given (i.e. can you tell who did what to whom, where, and how often)? – 1 point ☑
2.1 Were any important alternatives omitted (i.e. usual care)? – 1 point ☑
Score = 2/2

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3. Was the effectiveness of the programmes or services established? – 1 point ☑
3.1 If done through a RCT, did the trial protocol reflect what would happen in regular practice? – 1 point ☒
3.2a Was effectiveness established through an overview of clinical studies? – 1 point ☑
3.2b If observational data or assumptions were used to establish effectiveness did they address potential biases? – 1 point
Score = 2/3

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4. Were all the important and relevant costs and consequences for each alternative identified? – 1 point ☑
4.1 Was the range wide enough for the research question at hand? – 1 point ☑
4.2 Did it cover all relevant viewpoints? (Possible viewpoints include the community or social viewpoint, and those of patients and third-party payers. Other viewpoints may also be relevant depending upon the particular analysis.) – 1 point ☑
4.3 Were capital costs, as well as operating costs, included? – 1 point ☒
Score = 3/4

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5. Were costs and consequences measured accurately in appropriate physical units (e.g. hours of nursing time, number of physician visits, lost work-days, gained life-years)? – 1 point ☑
5.1 Were any of the identified items omitted from measurement? If so, does this mean that they carried no weight in the subsequent analysis? – 1 point ☑
Score = 2/2

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6. Were costs and consequences valued credibly? – 1 point ☑
6.1 Were the sources of all values clearly identified? (Possible sources include market values, patient or client preferences and views, policy-makers' views and health professionals' judgements). – 1 point ☑
6.2a Were market values employed for changes involving resources gained or depleted? – 1 point ☑
6.2b Where market values were absent (e.g. volunteer labour), or market values did not reflect actual values (such as clinic space donated at a reduced rate), were adjustments made to approximate market values? – 1 point
6.3 Was the valuation of consequences appropriate for the question posed (i.e. has the appropriate type or types of analysis – cost-effectiveness, cost-benefit, cost-utility – been selected)? – 1 point ☑
Score = 4/4

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7. Were costs and consequences adjusted for differential timing? – 1 point ☑ unnecessary <1 year horizon
7.1 Were costs and consequences which occur in the future 'discounted' to their present values? – 1 point ☑
7.2 Was any justification given for the discount rate used? – 1 point ☑
Score = 3/3

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8. Were the additional (incremental) costs generated by one alternative over another compared to the additional effects, benefits, or utilities generated? – 1 point ☑
Score = 1/1

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9. Was allowance made for uncertainty in the estimates of costs and consequences? – 1 point ☑
9.1 If data on costs or consequences were stochastic, were appropriate statistical analyses performed? – 1 point ☑

9.2. If a sensitivity analysis was employed, was justification provided for the ranges of values (for key study parameters)? – 1 point ☑

Score = 3/3

10. Did the presentation and discussion of study results include all issues of concern to users? – 1 point ☒

10.1 Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (e.g. cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion? – 1 point ☑

10.2 Were the results compared with those of others who have investigated the same question? If so, were allowances made for potential differences in study methodology? – 1 point ☒

10.3 Did the study discuss the generalisability of the results to other settings and patient/client groups? – 1 point ☒

10.4 Did the study allude to, or take account of, other important factors in the choice or decision under consideration (e.g. distribution of costs and consequences, or relevant ethical issues)? – 1 point ☒

10.5 Did the study discuss issues of implementation, such as the feasibility of adopting the 'preferred' programme given existing financial or other constraints, and whether any freed resources could be redeployed to other worthwhile programmes? – 1 point ☒

Score = 1/6

Article: Sevick *et al.* (2000)

1. Was a well-defined question posed in answerable form? – 1 point ☑

1.1 Did the study examine both costs and effects of the service(s) or programme(s)? – 1 point ☑

1.2 Did the study involve a comparison of alternatives? – 1 point ☑

1.3 Was a viewpoint for the analysis stated and was the study placed in any particular decision-making context? – 1 point ☑

Score = 4/4

2. Was a comprehensive description of the competing alternatives given (i.e. can you tell who did what to whom, where, and how often)? – 1 point ☑

2.1 Were any important alternatives omitted (i.e. usual care)? – 1 point ☒

Score = 1/2

3. Was the effectiveness of the programmes or services established? – 1 point ☑

3.1 If done through a RCT, did the trial protocol reflect what would happen in regular practice? – 1 point ☒

3.2a Was effectiveness established through an overview of clinical studies? – 1 point ☑

3.2b If observational data or assumptions were used to establish effectiveness did they address potential biases? – 1 point

Score = 2/3

4. Were all the important and relevant costs and consequences for each alternative identified? – 1 point ☑

4.1 Was the range wide enough for the research question at hand? – 1 point ☑

4.2 Did it cover all relevant viewpoints? (Possible viewpoints include the community or social viewpoint, and those of patients and third-party payers. Other viewpoints may also be relevant depending upon the particular analysis.) – 1 point ☑

4.3 Were capital costs, as well as operating costs, included? – 1 point ☒

Score = 3/4

5. Were costs and consequences measured accurately in appropriate physical units (e.g. hours of nursing time, number of physician visits, lost work-days, gained life-years)? – 1 point ☑

5.1 Were any of the identified items omitted from measurement? If so, does this mean that they carried no weight in the subsequent analysis? – 1 point ☑

Score = 2/2

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6. Were costs and consequences valued credibly? – 1 point ☑

6.1 Were the sources of all values clearly identified? (Possible sources include market values, patient or client preferences and views, policy-makers' views and health professionals' judgements). – 1 point ☑

6.2a Were market values employed for changes involving resources gained or depleted? – 1 point ☑

6.2b Where market values were absent (e.g. volunteer labour), or market values did not reflect actual values (such as clinic space donated at a reduced rate), were adjustments made to approximate market values? – 1 point

6.3 Was the valuation of consequences appropriate for the question posed (i.e. has the appropriate type or types of analysis – cost-effectiveness, cost-benefit, cost-utility – been selected)? – 1 point ☑

Score = 4/4

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7. Were costs and consequences adjusted for differential timing? – 1 point ☒

7.1 Were costs and consequences which occur in the future 'discounted' to their present values? – 1 point ☒

7.2 Was any justification given for the discount rate used? – 1 point ☒

Score = 0/3

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8. Were the additional (incremental) costs generated by one alternative over another compared to the additional effects, benefits, or utilities generated? – 1 point ☑

Score = 1/1

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9. Was allowance made for uncertainty in the estimates of costs and consequences? – 1 point ☑

9.1 If data on costs or consequences were stochastic, were appropriate statistical analyses performed? – 1 point ☒

9.2. If a sensitivity analysis was employed, was justification provided for the ranges of values (for key study parameters)? – 1 point ☑

Score = 2/3

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10. Did the presentation and discussion of study results include all issues of concern to users? – 1 point ☒

10.1 Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (e.g. cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion? – 1 point ☑

10.2 Were the results compared with those of others who have investigated the same question? If so, were allowances made for potential differences in study methodology? – 1 point ☒

10.3 Did the study discuss the generalisability of the results to other settings and patient/client groups? – 1 point ☒

10.4 Did the study allude to, or take account of, other important factors in the choice or decision under consideration (e.g. distribution of costs and consequences, or relevant ethical issues)? – 1 point ☒

10.5 Did the study discuss issues of implementation, such as the feasibility of adopting the 'preferred' programme given existing financial or other constraints, and whether any freed resources could be redeployed to other worthwhile programmes? – 1 point ☒

Score = 1/6

Article: Thomas *et al.* (2005)

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1. Was a well-defined question posed in answerable form? – 1 point ☑

1.1 Did the study examine both costs and effects of the service(s) or programme(s)? – 1 point ☑

1.2 Did the study involve a comparison of alternatives? – 1 point ☑

1.3 Was a viewpoint for the analysis stated and was the study placed in any particular decision-making context? – 1 point ☑

Score = 4/4

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2. Was a comprehensive description of the competing alternatives given (i.e. can you tell who did what to whom, where, and how often)? – 1 point ☑

2.1 Were any important alternatives omitted (i.e. usual care)? – 1 point ☒

Score = 1/2

3. **Was the effectiveness of the programmes or services established?** – 1 point ☑

3.1 If done through a RCT, did the trial protocol reflect what would happen in regular practice? – 1 point ☒

3.2a Was effectiveness established through an overview of clinical studies? – 1 point ☑

3.2b If observational data or assumptions were used to establish effectiveness did they address potential biases? – 1 point

Score = 2/3

4. **Were all the important and relevant costs and consequences for each alternative identified?** – 1 point ☑

4.1 Was the range wide enough for the research question at hand? – 1 point ☑

4.2 Did it cover all relevant viewpoints? (Possible viewpoints include the community or social viewpoint, and those of patients and third-party payers. Other viewpoints may also be relevant depending upon the particular analysis.) – 1 point ☑

4.3 Were capital costs, as well as operating costs, included? – 1 point ☒

Score = 3/4

5. **Were costs and consequences measured accurately in appropriate physical units (e.g. hours of nursing time, number of physician visits, lost work-days, gained life-years)?** – 1 point ☑

5.1 Were any of the identified items omitted from measurement? If so, does this mean that they carried no weight in the subsequent analysis? – 1 point ☑

Score = 2/2

6. **Were costs and consequences valued credibly?** – 1 point ☑

6.1 Were the sources of all values clearly identified? (Possible sources include market values, patient or client preferences and views, policy-makers' views and health professionals' judgements). – 1 point ☑

6.2a Were market values employed for changes involving resources gained or depleted? – 1 point ☑

6.2b Where market values were absent (e.g. volunteer labour), or market values did not reflect actual values (such as clinic space donated at a reduced rate), were adjustments made to approximate market values? – 1 point

6.3 Was the valuation of consequences appropriate for the question posed (i.e. has the appropriate type or types of analysis – cost-effectiveness, cost-benefit, cost-utility – been selected)? – 1 point ☑

Score = 4/4

7. **Were costs and consequences adjusted for differential timing?** – 1 point ☑

7.1 Were costs and consequences which occur in the future 'discounted' to their present values? – 1 point ☑

7.2 Was any justification given for the discount rate used? – 1 point ☒

Score = 2/3

8. **Were the additional (incremental) costs generated by one alternative over another compared to the additional effects, benefits, or utilities generated?** – 1 point ☑

Score = 1/1

9. **Was allowance made for uncertainty in the estimates of costs and consequences?** – 1 point ☑

9.1 If data on costs or consequences were stochastic, were appropriate statistical analyses performed? – 1 point ☑

9.2. If a sensitivity analysis was employed, was justification provided for the ranges of values (for key study parameters)? – 1 point ☑

Score = 3/3

10. **Did the presentation and discussion of study results include all issues of concern to users?** – 1 point ☒

10.1 Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (e.g. cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion? – 1 point ☑

10.2 Were the results compared with those of others who have investigated the same question? If so, were allowances made for potential differences in study methodology? – 1 point ☑

10.3 Did the study discuss the generalisability of the results to other settings and patient/client groups? – 1 point ☒

10.4 Did the study allude to, or take account of, other important factors in the choice or decision under consideration (e.g. distribution of costs and consequences, or relevant ethical issues)? – 1 point ☒

10.5 Did the study discuss issues of implementation, such as the feasibility of adopting the 'preferred' programme given existing financial or other constraints, and whether any freed resources could be redeployed to other worthwhile programmes? – 1 point ☒

Score = 2/6

Article: Korthals-de Bos *et al.* (2003)

1. **Was a well-defined question posed in answerable form?** – 1 point ☑
1.1 Did the study examine both costs and effects of the service(s) or programme(s)? – 1 point ☑
1.2 Did the study involve a comparison of alternatives? – 1 point ☑
1.3 Was a viewpoint for the analysis stated and was the study placed in any particular decision-making context? – 1 point ☑
Score = 4/4

2. **Was a comprehensive description of the competing alternatives given (i.e. can you tell who did what to whom, where, and how often)?** – 1 point ☑
2.1 Were any important alternatives omitted (i.e. usual care)? – 1 point ☒
Score = 1/2

3. **Was the effectiveness of the programmes or services established?** – 1 point ☑
3.1 If done through a RCT, did the trial protocol reflect what would happen in regular practice? – 1 point ☒
3.2a Was effectiveness established through an overview of clinical studies? – 1 point ☑
3.2b If observational data or assumptions were used to establish effectiveness did they address potential biases? – 1 point
Score = 2/3

4. **Were all the important and relevant costs and consequences for each alternative identified?** – 1 point [illegible]
4.1 Was the range wide enough for the research question at hand? – 1 point ☑
4.2 Did it cover all relevant viewpoints? (Possible viewpoints include the community or social viewpoint, and those of patients and third-party payers. Other viewpoints may also be relevant depending upon the particular analysis.) – 1 point ☑
4.3 Were capital costs, as well as operating costs, included? – 1 point ☒
Score = 3/4

5. **Were costs and consequences measured accurately in appropriate physical units (e.g. hours of nursing time, number of physician visits, lost work-days, gained life-years)?** – 1 point ☑
5.1 Were any of the identified items omitted from measurement? If so, does this mean that they carried no weight in the subsequent analysis? – 1 point ☑
Score = 2/2

6. **Were costs and consequences valued credibly?** – 1 point ☑
6.1 Were the sources of all values clearly identified? (Possible sources include market values, patient or client preferences and views, policy-makers' views and health professionals' judgements). – 1 point ☑
6.2a Were market values employed for changes involving resources gained or depleted? – 1 point ☑
6.2b Where market values were absent (e.g. volunteer labour), or market values did not reflect actual values (such as clinic space donated at a reduced rate), were adjustments made to approximate market values? – 1 point
6.3 Was the valuation of consequences appropriate for the question posed (i.e. has the appropriate type or types of analysis – cost-effectiveness, cost-benefit, cost-utility – been selected)? – 1 point ☑
Score = 4/4

7. **Were costs and consequences adjusted for differential timing?** – 1 point ☑ unnecessary <1 year horizon
7.1 Were costs and consequences which occur in the future 'discounted' to their present values? – 1 point ☑
7.2 Was any justification given for the discount rate used? – 1 point ☑

Score = 3/3

8. **Were the additional (incremental) costs generated by one alternative over another compared to the additional effects, benefits, or utilities generated?** – 1 point ☑
Score = 1/1

9. **Was allowance made for uncertainty in the estimates of costs and consequences?** – 1 point ☑
9.1 If data on costs or consequences were stochastic, were appropriate statistical analyses performed? – 1 point ☑
9.2. If a sensitivity analysis was employed, was justification provided for the ranges of values (for key study parameters)? – 1 point ☑
Score = 3/3

10. **Did the presentation and discussion of study results include all issues of concern to users?** – 1 point ☒
10.1 Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (e.g. cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion? – 1 point ☑
10.2 Were the results compared with those of others who have investigated the same question? If so, were allowances made for potential differences in study methodology? – 1 point ☑
10.3 Did the study discuss the generalisability of the results to other settings and patient/client groups? – 1 point ☒
10.4 Did the study allude to, or take account of, other important factors in the choice or decision under consideration (e.g. distribution of costs and consequences, or relevant ethical issues)? – 1 point ☒
10.5 Did the study discuss issues of implementation, such as the feasibility of adopting the 'preferred' programme given existing financial or other constraints, and whether any freed resources could be redeployed to other worthwhile programmes? – 1 point ☒
Score = 2/6

Article: Kemler *et al.* (2002)

1. **Was a well-defined question posed in answerable form?** – 1 point ☑
1.1 Did the study examine both costs and effects of the service(s) or programme(s)? – 1 point ☑
1.2 Did the study involve a comparison of alternatives? – 1 point ☑
1.3 Was a viewpoint for the analysis stated and was the study placed in any particular decision-making context? – 1 point ☑
Score = 4/4

2. **Was a comprehensive description of the competing alternatives given (i.e. can you tell who did what to whom, where, and how often)?** – 1 point ☑
2.1 Were any important alternatives omitted (i.e. usual care)? – 1 point ☒
Score = 1/2

3. **Was the effectiveness of the programmes or services established?** – 1 point ☑
3.1 If done through a RCT, did the trial protocol reflect what would happen in regular practice? – 1 point ☒
3.2a Was effectiveness established through an overview of clinical studies? – 1 point ☑
3.2b If observational data or assumptions were used to establish effectiveness did they address potential biases? – 1 point
Score = 2/3

4. **Were all the important and relevant costs and consequences for each alternative identified?** – 1 point ☑
4.1 Was the range wide enough for the research question at hand? – 1 point ☑
4.2 Did it cover all relevant viewpoints? (Possible viewpoints include the community or social viewpoint, and those of patients and third-party payers. Other viewpoints may also be relevant depending upon the particular analysis.) – 1 point ☑
4.3 Were capital costs, as well as operating costs, included? – 1 point ☒

Score = 3/4

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5. Were costs and consequences measured accurately in appropriate physical units (e.g. hours of nursing time, number of physician visits, lost work-days, gained life-years)? – 1 point ☑

5.1 Were any of the identified items omitted from measurement? If so, does this mean that they carried no weight in the subsequent analysis? – 1 point ☑

Score = 2/2

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6. Were costs and consequences valued credibly? – 1 point ☑

6.1 Were the sources of all values clearly identified? (Possible sources include market values, patient or client preferences and views, policy-makers' views and health professionals' judgements). – 1 point ☑

6.2a Were market values employed for changes involving resources gained or depleted? – 1 point ☑

6.2b Where market values were absent (e.g. volunteer labour), or market values did not reflect actual values (such as clinic space donated at a reduced rate), were adjustments made to approximate market values? – 1 point

6.3 Was the valuation of consequences appropriate for the question posed (i.e. has the appropriate type or types of analysis – cost-effectiveness, cost-benefit, cost-utility – been selected)? – 1 point ☑

Score = 4/4

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7. Were costs and consequences adjusted for differential timing? – 1 point ☑

7.1 Were costs and consequences which occur in the future 'discounted' to their present values? – 1 point ☑

7.2 Was any justification given for the discount rate used? – 1 point ☑

Score = 3/3

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8. Were the additional (incremental) costs generated by one alternative over another compared to the additional effects, benefits, or utilities generated? – 1 point ☑

Score = 1/1

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9. Was allowance made for uncertainty in the estimates of costs and consequences? – 1 point ☑

9.1 If data on costs or consequences were stochastic, were appropriate statistical analyses performed? – 1 point ☑

9.2. If a sensitivity analysis was employed, was justification provided for the ranges of values (for key study parameters)? – 1 point ☑

Score = 3/3

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10. Did the presentation and discussion of study results include all issues of concern to users? – 1 point ☒

10.1 Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (e.g. cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion? – 1 point ☑

10.2 Were the results compared with those of others who have investigated the same question? If so, were allowances made for potential differences in study methodology? – 1 point ☒

10.3 Did the study discuss the generalisability of the results to other settings and patient/client groups? – 1 point ☑

10.4 Did the study allude to, or take account of, other important factors in the choice or decision under consideration (e.g. distribution of costs and consequences, or relevant ethical issues)? – 1 point ☒

10.5 Did the study discuss issues of implementation, such as the feasibility of adopting the 'preferred' programme given existing financial or other constraints, and whether any freed resources could be redeployed to other worthwhile programmes? – 1 point ☒

Score = 3/6

Article: Pollock *et al.* (2005)

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1. **Was a well-defined question posed in answerable form?** – 1 point ☑

1.1 Did the study examine both costs and effects of the service(s) or programme(s)? – 1 point ☑

1.2 Did the study involve a comparison of alternatives? – 1 point ☑

1.3 Was a viewpoint for the analysis stated and was the study placed in any particular decision-making context? – 1 point ☑

Score = 4/4

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2. **Was a comprehensive description of the competing alternatives given (i.e. can you tell who did what to whom, where, and how often)?** – 1 point ☑

2.1 Were any important alternatives omitted (i.e. usual care)? – 1 point ☒

Score = 1/2

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3. **Was the effectiveness of the programmes or services established?** – 1 point ☑

3.1 If done through a RCT, did the trial protocol reflect what would happen in regular practice? – 1 point ☒

3.2a Was effectiveness established through an overview of clinical studies? – 1 point ☑

3.2b If observational data or assumptions were used to establish effectiveness did they address potential biases? – 1 point

Score = 2/3

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4. **Were all the important and relevant costs and consequences for each alternative identified?** – 1 point ☑

4.1 Was the range wide enough for the research question at hand? – 1 point ☑

4.2 Did it cover all relevant viewpoints? (Possible viewpoints include the community or social viewpoint, and those of patients and third-party payers. Other viewpoints may also be relevant depending upon the particular analysis.) – 1 point ☑

4.3 Were capital costs, as well as operating costs, included? – 1 point ☒

Score = 3/4

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5. **Were costs and consequences measured accurately in appropriate physical units (e.g. hours of nursing time, number of physician visits, lost work-days, gained life-years)?** – 1 point ☑

5.1 Were any of the identified items omitted from measurement? If so, does this mean that they carried no weight in the subsequent analysis? – 1 point ☑

Score = 2/2

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6. **Were costs and consequences valued credibly?** – 1 point ☑

6.1 Were the sources of all values clearly identified? (Possible sources include market values, patient or client preferences and views, policy-makers' views and health professionals' judgements). – 1 point ☑

6.2a Were market values employed for changes involving resources gained or depleted? – 1 point ☑

6.2b Where market values were absent (e.g. volunteer labour), or market values did not reflect actual values (such as clinic space donated at a reduced rate), were adjustments made to approximate market values? – 1 point

6.3 Was the valuation of consequences appropriate for the question posed (i.e. has the appropriate type or types of analysis – cost-effectiveness, cost-benefit, cost-utility – been selected)? – 1 point ☑

Score = 4/4

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7. **Were costs and consequences adjusted for differential timing?** – 1 point ☒

7.1 Were costs and consequences which occur in the future 'discounted' to their present values? – 1 point ☒

7.2 Was any justification given for the discount rate used? – 1 point ☒

Score = 0/3

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8. **Were the additional (incremental) costs generated by one alternative over another compared to the additional effects, benefits, or utilities generated?** – 1 point ☑

Score = 1/1

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9. **Was allowance made for uncertainty in the estimates of costs and consequences?** – 1 point ☑

9.1 If data on costs or consequences were stochastic, were appropriate statistical analyses performed? – 1 point ☒

9.2. If a sensitivity analysis was employed, was justification provided for the ranges of values (for key study parameters)? – 1 point ☑

Score = 2/3

10. Did the presentation and discussion of study results include all issues of concern to users? – 1 point ☒

10.1 Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (e.g. cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion? – 1 point ☑

10.2 Were the results compared with those of others who have investigated the same question? If so, were allowances made for potential differences in study methodology? – 1 point ☒

10.3 Did the study discuss the generalisability of the results to other settings and patient/client groups? – 1 point ☒

10.4 Did the study allude to, or take account of, other important factors in the choice or decision under consideration (e.g. distribution of costs and consequences, or relevant ethical issues)? – 1 point ☑

10.5 Did the study discuss issues of implementation, such as the feasibility of adopting the 'preferred' programme given existing financial or other constraints, and whether any freed resources could be redeployed to other worthwhile programmes? – 1 point ☒

Score = 2/6

APPENDIX 4-A: VISUAL PAIN SCALE AND PAIN DISABILITY INDEX

Faces Pain Scale – Revised (FPS-R)

In the following instructions, say "hurt" or "pain," whichever seems right for a particular child.

"These faces show how much something can hurt. This face *[point to left-most face]* **shows no pain. The faces show more and more pain** *[point to each from left to right]* **up to this one** *[point to right-most face]* **– it shows very much pain. Point to the face that shows how much you hurt** [right now]."

*Score the chosen face **0**, **2**, **4**, **6**, **8**, or **10**, counting left to right, so '**0**' = 'no pain' and '**10**' = 'very much pain.' Do not use words like 'happy' and 'sad'. This scale is intended to measure how children feel inside, not how their face looks.*

Hicks CL, von Baeyer CL, Spafford P, van Korlaar I, Goodenough B. The Faces Pain Scale – Revised: Toward a common metric in pediatric pain measurement. *Pain* 2001;93:173-183. Scale adapted from: Bieri D, Reeve R, Champion GD, Addicoat L, Ziegler J. The Faces Pain Scale for the self-assessment of the severity of pain experienced by children: Development, initial validation and preliminary investigation for ratio scale properties. *Pain* 1990;41:139-150.

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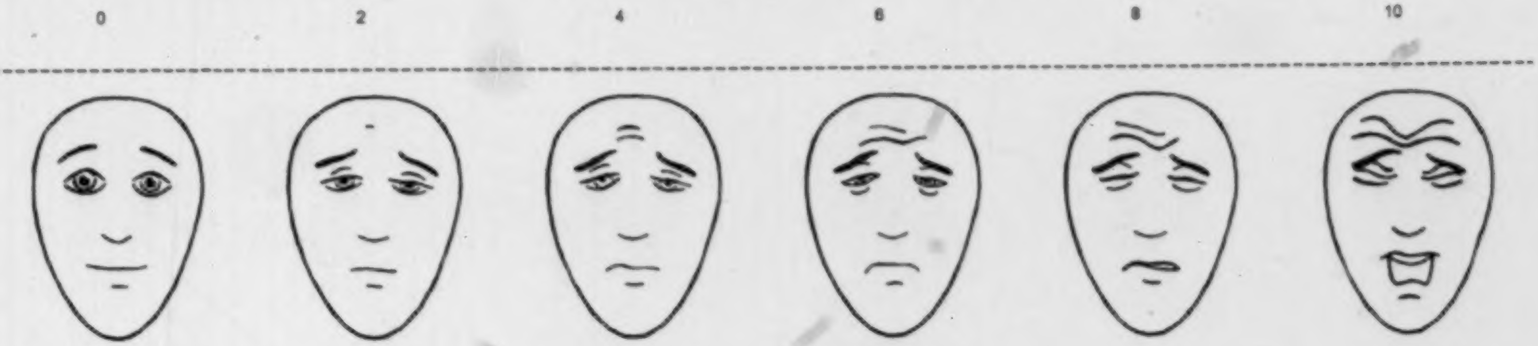
Fold here



Pain Disability Index

The rating scales below are designed to measure the degree to which several aspects of your life are presently disrupted by chronic pain. In other words, we would like to know how much your pain is preventing you from doing what you would normally do, or from doing it as well as you normally would.

Respond to each category by indicating the overall impact of pain in your life, not just when the pain is at its worst.

For each of the 7 categories of life activity listed, please circle the number on the scale which describes the level of disability you typically experience.

A score of 0 means no disability at all and a score of 10 signifies that all of the activities in which you would normally be involved have been totally disrupted or prevented by your pain.

(1) Family / Home Responsibilities

This category refers to activities related to the home or family. It includes chores or duties performed around the house (e.g. vacuuming) and errands or favours for other family members (e.g. driving the children to school).

0 1 2 3 4 5 6 7 8 9 10

No disability Mild Moderate Severe Total Disability

(2) Recreation

This category includes hobbies, sports and other similar leisure time activities.

0 1 2 3 4 5 6 7 8 9 10

No disability Mild Moderate Severe Total Disability

(3) Social Activity

This category refers to activities which involve participation with friends and acquaintances other than family members. It includes parties, theatre, concerts, cinema, dining out and other social functions.

0 1 2 3 4 5 6 7 8 9 10

No disability Mild Moderate Severe Total Disability

(4) Occupation

This category refers to activities that are part of or directly related to one's job. This includes non-paying jobs as well, such as that of a house-wife or volunteer worker.

0 1 2 3 4 5 6 7 8 9 10

No disability Mild Moderate Severe Total Disability

(5) Sexual Behaviour

This category refers to the frequency and quality of one's sex life.

0 1 2 3 4 5 6 7 8 9 10

No disability Mild Moderate Severe Total Disability

(6) Self Care

This category includes activities which involve personal maintenance and independent daily living (e.g. taking a shower, driving, getting dressed, etc).

0 1 2 3 4 5 6 7 8 9 10

No disability Mild Moderate Severe Total Disability

(7) Life Support Activity

This category refers to basic life-supporting behaviours such as eating, sleeping and breathing.

0 1 2 3 4 5 6 7 8 9 10

No disability Mild Moderate Severe Total Disability

APPENDIX 4-B: WTP QUESTIONNAIRE DESIGN

General Steps:

1. Characterizing context and hypothesis. This entails characterizing the health context such that respondents can provide valid responses. The payment vehicle chosen is out of pocket treatment cost after insurance. In the Canadian health care system, persons with chronic pain often pay a portion of their treatment cost out of pocket. Therefore it is assumed that persons with chronic pain are familiar with out of pocket payments for pain treatments. Final survey is piloted to determine level of protest responses and validity of responses.

2. Define relevant attributes to be valued: Attributes critical to persons with chronic pain are disability and pain intensity. Focus groups (or interviews) with patient population and interviews with clinical staff was conducted to identify appropriate terminology. Identified attributes were also reviewed for appropriateness by pilot testing. The focus group with patient population was conducted on May 1 2006.

3. Assigning attribute levels: characteristics of each attribute identified and reviewed for appropriateness through expert review and pilot testing.

4. Creating scenarios and survey questions. Each choice scenario (question) in the survey will consist of three alternatives (combinations of varying levels of attributes) from which respondents make their selection: two competing treatments described in terms of the attributes, and an option to reject both treatments. Questions will also be designed for orthogonality (i.e. no collinearity of attribute levels ensuring statistically efficiency),[1] and utility (level) balance (probability of choosing alternatives within a choice set should be as similar as possible).

5. Determining choice sets. Place levels into choice sets within scenarios.
    a. Illogical comparisons are defined as i) treatment that provide less improvement in both disability and pain but were cheaper than the alternative treatment, or ii) treatments that provide no improvement in both disability and pain. Choice questions with an illogical comparison were removed from the choice sets.
    b. Dominant comparisons are defined as a treatment that provided better improvement in both disability and pain but was also cheaper than the alternative. Choice questions with a dominant comparison were removed from the choice sets.

6. Add checks for heuristics and scope effects.
    a. Transitivity was tested by adding 2 additional choice questions that revealed preference rankings between the three choice questions.

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[1] Maddala T, Kathryn PA, Johnson RF. An experiment on simplifying conjoint analysis designs for measuring preferences. Health Economics 2003; 12:1035-1047.

b. Consistency was tested by considering the same choice comparison early in the survey and at the end.

Focus Group Guiding Questions

Pain Reduction and Pain Attributes

1. What would you be willing to pay to get:
    a. some pain relief or a slight improvement in your level of disability?
    b. moderate level of pain relief and moderate improvement in your level of disability?
    c. Lots of pain relief and a lot of improvement in your level of disability.
2. What is more important, a reduction in pain intensity or a reduction in pain disability; or are both the same?

Pilot Questionnaire

3. Is this questionnaire easy to understand?
4. In each choice question, was the ways that the treatments were presented clear and did it help you to think about the differences between treatments A and B.

5. Were the differences between treatments A and B clear?

6. Were these treatments credible? Do you believe a treatment could give you that level of improvement?

7. By the end of the questionnaire were you feeling fatigues or too tired to really think about the scenarios?

Focus Group Results Summary

Bid Range:

The way question is framed would pay anything. That is, would choose the treatment that offered most improvement regardless of price.

a. E.g. One participant said that they had recently paid $2000 for laser therapy and would be willing to pay it again.

E.g. if it was their child with pain would mortgage their house to provide child with treatment.

Placing boundaries on the bid range is extremely difficult and ambiguous.

b. Depends on too many factors:

Income
Number of dependents.
How long you have had pain.

Dollar values don't really mean anything.

Financial ability most important thing in determining whether they are willing to pay price of treatment.

It would be more meaningful to frame the question of in terms of percentage of income.

c. Range should go all the way to 100%.

This would be better than providing a bid range of dollar values.

Treatment Believability

Side effects are important so make sure people understand that the treatments assuming no side effects.

Degree of improvement believable. Would be willing to try any treatment.

Question Format

Choice questions very easy to understand.
The disability scale was very good and liked it very much.
Facial scale could be left in but using words were just as good.
Very familiar with the 10point types of scales and words (said they were common).
They could relate to the scale and did was intrinsically meaningful.
Format of the choice questions was good.

Final Choice Design for Attributes & Levels: TDEP

Important Notes: 1) Randomization of original survey was conducted using a random number generator in EXCEL.

Attribute and Level Coding

Attribute	**Coding for Improvement Levels**			
Pain Disability	Current(0)	Mild(1)	Moderate(2)	Severe(3)
Pain Intensity	Current(0)	Mild(1)	Moderate(2)	Severe(3)
Out of pocket price	$1000(0)	350(1)	100(2)	

Level Balance

Level	Attribute		
	Disability	Pain	Price
0	16	16	20
1	18	18	28
2	18	18	20
3	16	16	

Orthogonality

Kendall's tau_b Correlation Coefficient									
	Original			Folded Pair			All		
	Disability	Pain	Price	Disability	Pain	Price	Disability	Pain	Price
Disability	1	-0.28009	-0.11096	1	-0.11343	0.07061	1	-0.18938	0.001849
Pain	-0.28009	1	-0.11096	-0.11343	1	0.07061	-0.18938	1	0.001849
Price	-0.11096	-0.11096	1	0.07061	0.07061	1	0.001849	0.001849	1

Choice Key

Original					Fold Over (0-1, 1-2, 2-3,3-0)				Order in Survey	Comments
Code	Randomized Order on Original	Disability	Pain	Price$	Code	Disability	Pain	Price$		
2 2 1	29	moderate	moderate	350	3 3 2	severe	severe	100	1	Included choice questions. Primary analysis is conducted on these choice questions.
2 3 1	32	moderate	severe	350	3 0 2	severe	current	100	2	
3 1 0	37	severe	mild	1000	0 2 1	current	moderate	350	3	
3 0 2	36	severe	current	100	0 1 0	current	mild	1000	4	
2 0 0	22	moderate	current	1000	3 1 1	severe	mild	350	5	
2 1 0	25	moderate	mild	1000	3 2 1	severe	moderate	350	6	
3 1 1	38	severe	mild	350	0 2 2	current	moderate	100	7	
1 2 0	16	mild	moderate	1000	2 3 1	moderate	severe	350	8	
1 1 1	14	mild	mild	350	2 2 2	moderate	moderate	100	9	
0 3 1	8	current	severe	350	1 0 2	mild	current	100	10	
2 1 1	26	moderate	mild	350	3 2 2	severe	moderate	100	11	
0 1 1	2	current	mild	350	1 2 2	mild	moderate	100	12	
2 2 0	28	moderate	moderate	1000	3 3 1	severe	severe	350	13	
0 2 1	5	current	moderate	350	1 3 2	mild	severe	100	14	
0 3 2	9	current	severe	100	1 0 0	mild	current	1000	15	
1 3 0	19	mild	severe	1000	2 0 1	moderate	current	350	16	
0 2 0	4	current	moderate	1000	1 3 1	mild	severe	350	17	
1 3 1	20	mild	severe	350	2 0 2	moderate	current	100	18	
0 1 2	3	current	mild	100	1 2 0	mild	moderate	1000	19	
1 0 2	12	mild	current	100	2 1 0	moderate	mild	1000	20	
2 0 2	24	moderate	current	100	3 1 0	severe	mild	1000	21	
0 1 0	1	current	mild	1000	1 2 1	mild	moderate	350	22	
1 1 0	13	mild	mild	1000	2 2 1	moderate	moderate	350	23	
1 0 1	11	mild	current	350	2 1 2	moderate	mild	100	24	
1 2 1	17	mild	moderate	350	2 3 2	moderate	severe	100	25	
0 3 0	7	current	severe	1000	1 0 1	mild	current	350	26	

2 0 1	23	moderate	current	350	3 1 2	severe	mild	100	27	
3 2 1	41	severe	moderate	350	0 3 2	current	severe	100	28	
1 0 0	10	mild	current	1000	2 1 1	moderate	mild	350	29	
3 0 0	34	severe	current	1000	0 1 1	current	mild	350	30	
3 0 1	35	severe	current	350	0 1 2	current	mild	100	31	
3 2 0	40	severe	moderate	1000	0 3 1	current	severe	350	32	
0 2 2	6	current	moderate	100	1 3 0	mild	severe	1000	33	
2 3 0	31	moderate	severe	1000	3 0 1	severe	current	350	34	
0 3 2	9	current	severe	100	3 0 1	severe	current	350	trans35	added for transitivity test
0 3 2	9	current	severe	100	2 3 0	moderate	severe	1000	trans36	
2 [illegible]	[illegible]	moderate	moderate	350	3 3 2	severe	severe	100	37	[illegible] repeated for consistency test
3 3 0	43	severe	severe	1000	0 0 1	current	current	350		Removed due to dominance or illogical comparison.
3 3 1	44	severe	severe	350	0 0 2	current	current	100		
1 1 2	15	mild	mild	100	2 2 0	moderate	moderate	1000		
1 2 2	18	mild	moderate	100	2 3 0	moderate	severe	1000		
1 3 2	21	mild	severe	100	2 0 0	moderate	current	1000		
2 1 2	27	moderate	mild	100	3 2 0	severe	moderate	1000		
2 2 2	30	moderate	moderate	100	3 3 0	severe	severe	1000		
2 3 2	33	moderate	severe	100	3 0 0	severe	current	1000		
3 1 2	39	severe	mild	100	0 2 0	current	moderate	1000		
3 2 2	42	severe	moderate	100	0 3 0	current	severe	1000		
3 3 2	45	severe	severe	100	0 0 0	current	current	1000		

Final Choice Design for Attributes & Levels: TDSP

Important Notes: 1) Randomization of original survey was conducted using a random number generator in EXCEL.

Attribute and Level Coding

Attribute	Coding for Improvement Levels			
Pain Disability	Current(0)	Mild(1)	Moderate(2)	Severe(3)
Pain Intensity	Current(0)	Mild(1)	Moderate(2)	
Out of pocket price	$1000(0)	350(1)	100(2)	

Level Balance

Level	Attribute		
	Disability	Pain	Price
0	16	16	20
1	18	18	28
2	18	18	20
3	16	16	

Orthogonality

Kendall's tau_b Correlation Coefficient									
	Original			Folded Pair			All		
	Disability	Pain	Price	Disability	Pain	Price	Disability	Pain	Price
Disability	1	-0.28009	-0.11096	1	-0.11343	0.07061	1	-0.18938	0.001849
Pain	-0.28009	1	-0.11096	-0.11343	1	0.07061	-0.18938	1	0.001849
Price	-0.11096	-0.11096	1	0.07061	0.07061	1	0.001849	0.001849	1

Choice Key

Original					Fold Over (0-1, 1-2, 2-3,3-0)				Order in Survey	Comments
Code	Randomized Order on Original	Disability	Pain	Price$	Code	Disability	Pain	Price$		
1 0 0	10	mild	current	1000	2 1 1	moderate	mild	350	1	Included choice questions. Primary analysis is conducted on these choice questions.
1 1 1	14	mild	mild	350	2 2 2	moderate	moderate	100	2	
1 2 0	16	mild	moderate	1000	2 0 1	moderate	current	350	3	
0 1 2	3	current	mild	100	1 2 0	mild	moderate	1000	4	
3 1 0	37	severe	mild	1000	0 2 1	current	moderate	350	5	
2 0 1	23	moderate	current	350	3 1 2	severe	mild	100	6	
2 2 1	29	moderate	moderate	350	3 0 2	severe	current	100	7	
0 2 2	6	current	moderate	100	1 0 0	mild	current	1000	8	
0 1 0	1	current	mild	1000	1 2 1	mild	moderate	350	9	
1 0 2	12	mild	current	100	2 1 0	moderate	mild	1000	10	
3 0 2	36	severe	current	100	0 1 0	current	mild	1000	11	
1 0 1	11	mild	current	350	2 1 2	moderate	mild	100	12	
0 2 0	4	current	moderate	1000	1 0 1	mild	current	350	13	
2 0 2	24	moderate	current	100	3 1 0	severe	mild	1000	14	
2 1 1	26	moderate	mild	350	3 2 2	severe	moderate	100	15	
2 2 0	28	moderate	moderate	1000	3 0 1	severe	current	350	16	
1 2 1	17	mild	moderate	350	2 0 2	moderate	current	100	17	
3 1 1	38	severe	mild	350	0 2 2	current	moderate	100	18	
2 0 0	22	moderate	current	1000	3 1 1	severe	mild	350	19	
3 0 0	34	severe	current	1000	0 1 1	current	mild	350	20	
3 0 1	35	severe	current	350	0 1 2	current	mild	100	21	
0 2 1	5	current	moderate	350	1 0 2	mild	current	100	22	
0 1 1	2	current	mild	350	1 2 2	mild	moderate	100	23	
2 1 0	25	moderate	mild	1000	3 2 1	severe	moderate	350	24	
1 1 0	13	mild	mild	1000	2 2 1	moderate	moderate	350	25	
3 1 2	23	severe	mild	100	2 2 1	moderate	moderate	350	trans26	added for transitivity test
3 1 2	23	severe	mild	100	1 1 0	mild	mild	1000	trans27	

[illegible]	[illegible]	mild	current	1000	[illegible]	moderate	mild	350	[illegible]	[illegible]
3 2 0	40	severe	moderate	1000	0 0 1	current	current	350		Removed due to dominance or illogical comparison.
3 2 1	41	severe	moderate	350	0 0 2	current	current	100		
1 1 2	15	mild	mild	100	2 2 0	moderate	moderate	1000		
1 2 2	18	mild	moderate	100	2 0 0	moderate	current	1000		
2 1 2	27	moderate	mild	100	3 2 0	severe	moderate	1000		
2 2 2	30	moderate	moderate	100	3 0 0	severe	current	1000		
3 1 2	39	severe	mild	100	0 2 0	current	moderate	1000		
3 2 2	42	severe	moderate	100	0 0 0	current	current	1000		

Final Choice Design for Attributes & Levels: TDMP

Important Notes: 1) Randomization of original survey was conducted using a random number generator in EXCEL.

Attribute and Level Coding

Attribute	**Coding for Improvement Levels**			
Pain Disability	Current(0)	Mild(1)	Moderate(2)	Severe(3)
Pain Intensity	Current(0)	Mild(1)		
Out of pocket price	$1000(0)	350(1)	100(2)	

Level Balance

Level	Attribute		
	Disability	Pain	Price
0	6	16	10
1	8	16	12
2	10	0	10
3	8	0	

Orthogonality

Kendall's tau_b Correlation Coefficient									
	Original			Folded Pair			All		
	Disability	Pain	Price	Disability	Pain	Price	Disability	Pain	Price
Disability	1	-0.50679	0	1	-0.03898	0.09003	1	-0.25008	0.069552
Pain	-0.50679	1	-0.16496	-0.03898	1	-0.16496	-0.25008	1	-0.14914
Price	0	-0.16496	1	0.09003	-0.16496	1	0.069552	-0.14914	1

Choice Key

Original					Fold Over (0-1, 1-2, 2-3,3-0)				Order in Survey	Comments
Code	Randomized Order on Original	Disability	Pain	Price$	Code	Disability	Pain	Price$		
2 1 1	26	moderate	mild	350	3 0 2	severe	current	100	1	Included choice questions. Primary analysis is conducted on these choice questions.
2 0 2	24	moderate	current	100	3 1 0	severe	mild	1000	2	
1 0 2	12	mild	current	100	2 1 0	moderate	mild	1000	3	
3 0 2	36	severe	current	100	0 1 0	current	mild	1000	4	
0 1 2	3	current	mild	100	1 0 0	mild	current	1000	5	
2 0 1	23	moderate	current	350	3 1 2	severe	mild	100	6	
3 0 1	35	severe	current	350	0 1 2	current	mild	100	7	
1 0 1	11	mild	current	350	2 1 2	moderate	mild	100	8	
0 1 1	2	current	mild	350	1 0 2	mild	current	100	9	
1 1 1	14	mild	mild	350	2 0 2	moderate	current	100	10	
2 0 0	22	moderate	current	1000	3 1 1	severe	mild	350	11	
1 1 0	13	mild	mild	1000	2 0 1	moderate	current	350	12	
1 0 0	10	mild	current	1000	2 1 1	moderate	mild	350	13	
3 0 0	34	severe	current	1000	0 1 1	current	mild	350	14	
2 1 0	25	moderate	mild	1000	3 0 1	severe	current	350	15	
0 1 0	1	current	mild	1000	1 0 1	mild	current	350	16	
3 0 2	36	severe	current	100	1 0 1	mild	current	350	trans17	added for transitivity test
3 0 2	36	severe	current	100	0 1 0	current	mild	1000	trans18	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3 0 2	severe	current	100	19	[illegible] consistency
3 1 0	37	severe	mild	1000	0 0 1	current	current	350		Removed due to dominance or illogical comparison.
3 1 1	38	severe	mild	350	0 0 2	current	current	100		
1 1 2	15	mild	mild	100	2 0 0	moderate	current	1000		
2 1 2	27	moderate	mild	100	3 0 0	severe	current	1000		
3 1 2	39	severe	mild	100	0 0 0	current	current	1000		

Final Choice Design for Attributes & Levels: SDEP

Important Notes: 1) Randomization of original survey was conducted using a random number generator in EXCEL.

Attribute and Level Coding

Attribute	Coding for Improvement Levels			
Pain Disability	Current(0)	Mild(1)	Moderate(2)	
Pain Intensity	Current(0)	Mild(1)	Moderate(2)	Severe(3)
Out of pocket price	$1000(0)	350(1)	100(2)	

Level Balance

Level	Attribute		
	Disability	Pain	Price
0	16	11	15
1	18	13	20
2	16	14	15
3	0	12	

Orthogonality

Kendall's tau_b Correlation Coefficient									
	Original			Folded Pair			All		
	Disability	Pain	Price	Disability	Pain	Price	Disability	Pain	Price
Disability	1	-0.36427	-0.13761	1	-0.11839	0.039318	1	-0.22903	-0.02776
Pain	-0.36427	1	-0.07412	-0.11839	1	0.074119	-0.22903	1	0.02391
Price	-0.13761	-0.07412	1	0.039318	0.074119	1	-0.02776	0.02391	1

Choice Key

Original					Fold Over (0-1, 1-2, 2-3,3-0)				Order in Survey	Comments
Code	Randomized Order on Original	Disability	Pain	Price$	Code	Disability	Pain	Price$		
1 1 0	13	mild	mild	1000	2 2 1	moderate	moderate	350	1	Included choice questions. Primary analysis is conducted on these choice questions.
1 2 1	17	mild	moderate	350	2 3 2	moderate	severe	100	2	
2 0 0	22	moderate	current	1000	0 1 1	current	mild	350	3	
2 1 1	26	moderate	mild	350	0 2 2	current	moderate	100	4	
1 0 0	10	mild	current	1000	2 1 1	moderate	mild	350	5	
1 0 1	11	mild	current	350	2 1 2	moderate	mild	100	6	
0 3 1	8	current	severe	350	1 0 2	mild	current	100	7	
1 0 2	12	mild	current	100	2 1 0	moderate	mild	1000	8	
0 1 1	2	current	mild	350	1 2 2	mild	moderate	100	9	
0 3 0	7	current	severe	1000	1 0 1	mild	current	350	10	
1 3 1	20	mild	severe	350	2 0 2	moderate	current	100	11	
0 1 0	1	current	mild	1000	1 2 1	mild	moderate	350	12	
2 0 2	24	moderate	current	100	0 1 0	current	mild	1000	13	
0 3 2	9	current	severe	100	1 0 0	mild	current	1000	14	
0 1 2	3	current	mild	100	1 2 0	mild	moderate	1000	15	
2 0 1	23	moderate	current	350	0 1 2	current	mild	100	16	
2 1 0	25	moderate	mild	1000	0 2 1	current	moderate	350	17	
1 3 0	19	mild	severe	1000	2 0 1	moderate	current	350	18	
0 2 0	4	current	moderate	1000	1 3 1	mild	severe	350	19	
1 1 1	14	mild	mild	350	2 2 2	moderate	moderate	100	20	
2 2 0	28	moderate	moderate	1000	0 3 1	current	severe	350	21	
0 2 1	5	current	moderate	350	1 3 2	mild	severe	100	22	
0 2 2	6	current	moderate	100	1 3 0	mild	severe	1000	23	
2 2 1	29	moderate	moderate	350	0 3 2	current	severe	100	24	
1 2 0	16	mild	moderate	1000	2 3 1	moderate	severe	350	25	
0 1 2	23	current	mild	100	2 3 1	moderate	severe	350	trans26	added for

0 1 2	23	current	mild	100	1 2 0	mild	moderate	1000	trans27	transitivity test
1 0	13	mild	mild	1000	[illegible]	moderate	moderate	350	28	#1 is repeated for consistency
2 3 0	31	moderate	severe	1000	0 0 1	current	current	350		Removed due to dominance or illogical comparison.
2 3 1	32	moderate	severe	350	0 0 2	current	current	100		
1 1 2	15	mild	mild	100	2 2 0	moderate	moderate	1000		
1 2 2	18	mild	moderate	100	2 3 0	moderate	severe	1000		
1 3 2	21	mild	severe	100	2 0 0	moderate	current	1000		
2 1 2	27	moderate	mild	100	0 2 0	current	moderate	1000		
2 2 2	30	moderate	moderate	100	0 3 0	current	severe	1000		
2 3 2	33	moderate	severe	100	0 0 0	current	current	1000		

Final Choice Design for Attributes & Levels: SDSP

Important Notes: 1) Randomization of original survey was conducted using a random number generator in EXCEL.

Attribute and Level Coding

Attribute	Coding for Improvement Levels		
Pain Disability	Current(0)	Mild(1)	Moderate(2)
Pain Intensity	Current(0)	Mild(1)	Moderate(2)
Out of pocket price	$1000(0)	350(1)	100(2)

Level Balance

Level	Attribute		
	Disability	Pain	Price
0	11	11	11
1	13	13	14
2	12	12	11
3	0	0	

Orthogonality

Kendall's tau_b Correlation Coefficient									
	Original			Folded Pair			All		
	Disability	Pain	Price	Disability	Pain	Price	Disability	Pain	Price
Disability	1	-0.48598	-0.09434	1	-0.14953	0.056606	1	-0.29698	0.002326
Pain	-0.48598	1	-0.09434	-0.14953	1	0.056606	-0.29698	1	0.002326
Price	-0.09434	-0.09434	1	0.056606	0.056606	1	0.002326	0.002326	1

Choice Key

Original					Fold Over (0-1, 1-2, 2-3,3-0)				Order in Survey	Comments
Code	Randomized Order on Original	Disability	Pain	Price$	Code	Disability	Pain	Price$		
1 0 0	10	mild	current	1000	2 1 1	moderate	mild	350	1	Included choice questions. Primary analysis is conducted on these choice questions.
1 0 2	12	mild	current	100	2 1 0	moderate	mild	1000	2	
2 0 2	24	moderate	current	100	0 1 0	current	mild	1000	3	
0 1 2	3	current	mild	100	1 2 0	mild	moderate	1000	4	
1 2 0	16	mild	moderate	1000	2 0 1	moderate	current	350	5	
1 0 1	11	mild	current	350	2 1 2	moderate	mild	100	6	
1 1 0	13	mild	mild	1000	2 2 1	moderate	moderate	350	7	
2 0 0	22	moderate	current	1000	0 1 1	current	mild	350	8	
2 1 0	25	moderate	mild	1000	0 2 1	current	moderate	350	9	
0 2 1	5	current	moderate	350	1 0 2	mild	current	100	10	
1 1 1	14	mild	mild	350	2 2 2	moderate	moderate	100	11	
0 1 0	1	current	mild	1000	1 2 1	mild	moderate	350	12	
2 0 1	23	moderate	current	350	0 1 2	current	mild	100	13	
0 2 0	4	current	moderate	1000	1 0 1	mild	current	350	14	
0 2 2	6	current	moderate	100	1 0 0	mild	current	1000	15	
2 1 1	26	moderate	mild	350	0 2 2	current	moderate	100	16	
0 1 1	2	current	mild	350	1 2 2	mild	moderate	100	17	
1 2 1	17	mild	moderate	350	2 0 2	moderate	current	100	18	
1 1 0	13	mild	mild	1000	2 0 2	moderate	current	100	trans19	added for transitivity test
1 1 0	13	mild	mild	1000	1 2 1	mild	moderate	350	trans20	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2 2 0	28	moderate	moderate	1000	0 0 1	current	current	350		Removed due to dominance or illogical
2 2 1	29	moderate	moderate	350	0 0 2	current	current	100		
1 1 2	15	mild	mild	100	2 2 0	moderate	moderate	1000		

1 2 2	18	mild	moderate	100	2	0	0	moderate	current	1000		comparison.
2 1 2	27	moderate	mild	100	0	2	0	current	moderate	1000		
2 2 2	30	moderate	moderate	100	0	0	0	current	current	1000		

Final Choice Design for Attributes & Levels: SDMP

Important Notes: 1) Randomization of original survey was conducted using a random number generator in EXCEL.

Attribute and Level Coding

Attribute	Coding for Improvement Levels		
Pain Disability	Current(0)	Mild(1)	Moderate(2)
Pain Intensity	Current(0)	Mild(1)	
Out of pocket price	$1000(0)	350(1)	100(2)

Level Balance

Level	Attribute		
	Disability	Pain	Price
0	6	11	7
1	8	11	8
2	8	0	7
3	0	0	

Orthogonality

Kendall's tau_b Correlation Coefficient

	Original			Folded Pair			All		
	Disability	Pain	Price	Disability	Pain	Price	Disability	Pain	Price
Disability	1	-0.70165	0	1	-0.17541	0.101274	1	-0.41685	0.068536
Pain	-0.70165	1	-0.11547	-0.17541	1	-0.11547	-0.41685	1	-0.10747
Price	0	-0.11547	1	0.101274	-0.11547	1	0.068536	-0.10747	1

Choice Key

Original					Fold Over (0-1, 1-2, 2-3,3-0)				Order in Survey	Comments
Code	Randomized Order on Original	Disability	Pain	Price$	Code	Disability	Pain	Price$		
2 0 1	23	moderate	current	350	0 1 2	current	mild	100	1	Included choice questions. Primary analysis is conducted on these choice questions.
2 0 0	22	moderate	current	1000	0 1 1	current	mild	350	2	
1 0 1	11	mild	current	350	2 1 2	moderate	mild	100	3	
0 1 2	3	current	mild	100	1 0 0	mild	current	1000	4	
1 1 1	14	mild	mild	350	2 0 2	moderate	current	100	5	
2 0 2	24	moderate	current	100	0 1 0	current	mild	1000	6	
1 0 0	10	mild	current	1000	2 1 1	moderate	mild	350	7	
0 1 1	2	current	mild	350	1 0 2	mild	current	100	8	
1 0 2	12	mild	current	100	2 1 0	moderate	mild	1000	9	
0 1 0	1	current	mild	1000	1 0 1	mild	current	350	10	
1 1 0	13	mild	mild	1000	2 0 1	moderate	current	350	11	
2 1 2	11	moderate	mild	100	2 0 1	moderate	current	350	12	added for transitivity test
2 1 2	11	moderate	mild	100	1 1 0	mild	mild	1000	13	

2 1 0	25	moderate	mild	1000	0 0 1	current	current	350		Removed due to dominance or illogical comparison.
2 1 1	26	moderate	mild	350	0 0 2	current	current	100		
1 1 2	15	mild	mild	100	2 0 0	moderate	current	1000		
2 1 2	27	moderate	mild	100	0 0 0	current	current	1000		

Final Choice Design for Attributes & Levels: MDEP

Important Notes: 1) Randomization of original survey was conducted using a random number generator in EXCEL.

Attribute and Level Coding

Attribute	**Coding for Improvement Levels**			
Pain Disability	Current(0)	Mild(1)		
Pain Intensity	Current(0)	Mild(1)	Moderate(2)	Severe(3)
Out of pocket price	$1000(0)	350(1)	100(2)	

Level Balance

Level	Attribute		
	Disability	Pain	Price
0	16	6	10
1	16	8	12
2	0	10	10
3	0	8	

Orthogonality

Kendall's tau_b Correlation Coefficient

	Original			Folded Pair			All		
	Disability	Pain	Price	Disability	Pain	Price	Disability	Pain	Price
Disability	1	-0.50679	-0.16496	1	-0.03898	-0.16496	1	-0.25008	-0.14914
Pain	-0.50679	1	0	-0.03898	1	0.09003	-0.25008	1	0.069552
Price	-0.16496	0	1	-0.16496	0.09003	1	-0.14914	0.069552	1

Choice Key

Original					Fold Over (0-1, 1-2, 2-3,3-0)				Order in Survey	Comments
Code	Randomized Order on Original	Disability	Pain	Price$	Code	Disability	Pain	Price$		
0 1 2	3	current	mild	100	1 2 0	mild	moderate	1000	1	Included choice questions. Primary analysis is conducted on these choice questions.
1 1 0	13	mild	mild	1000	0 2 1	current	moderate	350	2	
1 0 2	12	mild	current	100	0 1 0	current	mild	1000	3	
1 2 1	17	mild	moderate	350	0 3 2	current	severe	100	4	
0 2 2	6	current	moderate	100	1 3 0	mild	severe	1000	5	
0 1 0	1	current	mild	1000	1 2 1	mild	moderate	350	6	
0 2 1	5	current	moderate	350	1 3 2	mild	severe	100	7	
0 3 1	8	current	severe	350	1 0 2	mild	current	100	8	
0 2 0	4	current	moderate	1000	1 3 1	mild	severe	350	9	
0 1 1	2	current	mild	350	1 2 2	mild	moderate	100	10	
1 0 1	11	mild	current	350	0 1 2	current	mild	100	11	
1 0 0	10	mild	current	1000	0 1 1	current	mild	350	12	
0 3 2	9	current	severe	100	1 0 0	mild	current	1000	13	
1 1 1	14	mild	mild	350	0 2 2	current	moderate	100	14	
0 3 0	7	current	severe	1000	1 0 1	mild	current	350	15	
1 2 0	16	mild	moderate	1000	0 3 1	current	severe	350	16	
1 0 2	8	mild	current	100	0 3 1	current	severe	350	trans17	added for transitivity test
1 0 2	8	mild	current	100	1 2 0	mild	moderate	1000	trans18	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
1 3 0	19	mild	severe	1000	0 0 1	current	current	350		Removed due to dominance or illogical comparison.
1 3 1	20	mild	severe	350	0 0 2	current	current	100		
1 1 2	15	mild	mild	100	0 2 0	current	moderate	1000		
1 2 2	18	mild	moderate	100	0 3 0	current	severe	1000		
1 3 2	21	mild	severe	100	0 0 0	current	current	1000		

Final Choice Design for Attributes & Levels: MDSP

Important Notes: 1) Randomization of original survey was conducted using a random number generator in EXCEL.

Attribute and Level Coding

Attribute	Coding for Improvement Levels		
Pain Disability	Current(0)	Mild(1)	
Pain Intensity	Current(0)	Mild(1)	Moderate(2)
Out of pocket price	$1000(0)	350(1)	100(2)

Level Balance

Level	Attribute		
	Disability	Pain	Price
0	11	6	7
1	11	8	8
2	0	8	7
3	0	0	

Orthogonality

Kendall's tau_b Correlation Coefficient									
	Original			Folded Pair			All		
	Disability	Pain	Price	Disability	Pain	Price	Disability	Pain	Price
Disability	1	-0.70165	-0.11547	1	-0.17541	-0.11547	1	-0.41685	-0.10747
Pain	-0.70165	1	0	-0.17541	1	0.101274	-0.41685	1	0.068536
Price	-0.11547	0	1	-0.11547	0.101274	1	-0.10747	0.068536	1

Choice Key

Original					Fold Over (0-1, 1-2, 2-3,3-0)				Order In Survey	Comments
Code	Randomized Order on Original	Disability	Pain	Price$	Code	Disability	Pain	Price$		
0 2 1	5	current	moderate	350	1 0 2	mild	current	100	1	Included choice questions. Primary analysis is conducted on these choice questions.
1 1 1	14	mild	mild	350	0 2 2	current	moderate	100	2	
0 1 1	2	current	mild	350	1 2 2	mild	moderate	100	3	
0 1 0	1	current	mild	1000	1 2 1	mild	moderate	350	4	
1 0 0	10	mild	current	1000	0 1 1	current	mild	350	5	
0 1 2	3	current	mild	100	1 2 0	mild	moderate	1000	6	
1 1 0	13	mild	mild	1000	0 2 1	current	moderate	350	7	
1 0 1	11	mild	current	350	0 1 2	current	mild	100	8	
0 2 0	4	current	moderate	1000	1 0 1	mild	current	350	9	
1 0 2	12	mild	current	100	0 1 0	current	mild	1000	10	
0 2 2	6	current	moderate	100	1 0 0	mild	current	1000	11	
0 1 1	2	current	mild	350	1 0 0	mild	current	1000	12	added for transitivity test
0 1 1	2	current	mild	350	0 2 2	current	moderate	100	13	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
1 2 0	16	mild	moderate	1000	0 0 1	current	current	350		Removed due to dominance or illogical comparison.
1 2 1	17	mild	moderate	350	0 0 2	current	current	100		
1 1 2	15	mild	mild	100	0 2 0	current	moderate	1000		
1 2 2	18	mild	moderate	100	0 0 0	current	current	1000		

APPENDIX 4-C: PILOT TESTING RESULTS

Characteristics of Pilot Population

Variable	SDEP	SDSP	MDEP	MDSP
Sample Size	3	6	2	4
WTP Survey Validity Checks				
Improvement unrealistic/unbelievable	66	50	100	75
Certain would buy treatments chosen	66.7	75.8	54.7	51.1
Failed Consistency Check	0	0	0	0
Failed Transitivity Check	0	4.5	0	4
WTP (note that max price was $600)				
Mild Disability	$425	$323	$145	$184
Moderate Disability	$278	$182	—	—
Mild Pain	$885	$963	$867	$808
Moderate Pain	$545	$620	$645	$435
Severe Pain	$203	—	$212	—
% Rejecting $600 Treatment	70%	50%	63%	0%

Note. In pilot $600 per month was the maximum price of any treatment

Characteristics of Study Population

Variable	SDEP	SDSP	MDEP	MDSP
Sample Size	15	24	3	36
WTP Survey Validity Checks				
Improvement unrealistic/unbelievable	8.3	0	0	10
Certain would buy treatments chosen	80.0	83.3	66.7	63.9
Failed Consistency Check	0	0	0	0
Failed Transitivity Check	6.7	8.3	0	5.6
% Rejecting $1000 Treatment	75%	78%	80%	85%

APPENDIX 4-D: EQ-5D QUESTIONNAIRE

EQ - 5D

Health Questionnaire

(Canadian English version)

By placing a check-mark in one box in each group below, please indicate which statements best describe your own state of health today.

Mobility

I have no problems in walking about ☐

I have some problems in walking about ☐

I am confined to bed ☐

Self-Care

I have no problems with self-care ☐

I have some problems washing or dressing myself ☐

I am unable to wash or dress myself ☐

Usual Activities *(e.g. work, study, housework, family or leisure activities)*

I have no problems with performing my usual activities ☐

I have some problems with performing my usual activities ☐

I am unable to perform my usual activities ☐

Pain/Discomfort

I have no pain or discomfort ☐

I have moderate pain or discomfort ☐

I have extreme pain or discomfort ☐

Anxiety/Depression

I am not anxious or depressed ☐

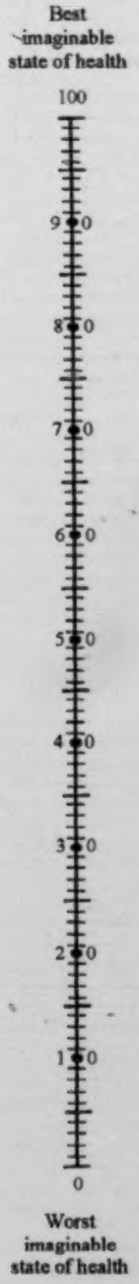
I am moderately anxious or depressed ☐

I am extremely anxious or depressed ☐

To help people say how good or bad their state of health is, we have drawn a scale (rather like a thermometer) on which the best state you can imagine is marked 100 and the worst state you can imagine is marked 0.

We would like you to indicate on this scale how good or bad your own health is today, in your opinion. Please do this by drawing a line from the box below to whichever point on the scale indicates how good or bad your state of health is today.

Your own
state of health
today


Best
imaginable
state of health
100
9●0
8●0
7●0
6●0
5●0
4●0
3●0
2●0
1●0
0
Worst
imaginable
state of health

APPENDIX 4-E: BACKGROUND AND DEBRIEFING QUESTIONNAIRE

Background Questions

1) Please indicate the number of years you have experienced chronic pain.

   Number of years: ________.

2) Please indicate the number of adults living in your household.

   Number of adults: ________.

3) Please indicate the number of dependent children living in your household.

   Number of dependent children: ________.

4) At the present time do you smoke cigarettes daily, occasionally, not at all, or are you a former smoker (**please circle one**)?

   a) Daily

   b) Occasionally

   c) Not At All

   d) Former Smoker

5) Please indicate your marital status (**please circle one**):

   a) Married or Common Law

   b) Divorced

   c) Widowed

   d) Single

6) What is your best estimate of your total yearly household income from all sources before any taxes or deductions (**please circle one**)?

a) Less than $10,000

b) $10,000 – $19,999

c) $20,000 – $29,999

d) $30,000 – $39,999

e) $40,000 – $59,999

f) $60,000 – $79,999

g) $80,000 – $99,999

h) $100,000 – $149,999

i) Greater than $150,000

7) Please indicate whether you have the following chronic conditions that have been diagnosed by a health professional. **Please circle all that apply**.

a) Food allergies
b) Any other allergies
c) Asthma
d) Arthritis or rheumatism
e) Back problems, excluding arthritis
f) High blood pressure
g) Migraine headache
h) Chronic Bronchitis or emphysema
i) Sinusitis
j) Diabetes
k) Epilepsy
l) Heart Disease
m) Cancer
n) Stomach or intestinal ulcers
o) Effects of a stroke
p) Depression
q) Fibromyalgia

r) Any other chronic pain condition that has been diagnosed by a health professional

(Please specify ______________________________)

s) Any other long term condition (excluding pain) that has been diagnosed by a health

(Please specify ______________________________)

8) What is the highest level of education that you have completed (**please circle one**)?

a) Less than High School
b) High School Graduate
c) Trade School or Technical School (e.g. carpentry, plumbing, graphic design, NAIT, SAIT)
d) Some College or University (e.g. University of Alberta, Grant McEwan)
e) College or University Graduate

9) People in Canada come from many different cultural backgrounds. To which cultural background do you belong (**please circle one**)?

a) Caucasian

b) Chinese?

c) South Asian (e.g. East Indian, Pakistani, Sri Lanken)?

d) First Nations Peoples of North America (e.g. North American Indian, Metis, Inuit)?

e) Latin American (e.g. Mexican, Chilean, Costa Rican)?

f) Arab?

g) Black?

h) Other? - Please Specify

________________________.

10) The highest price for any treatment option was $1,000 per month. Would you be willing to pay more than $1,000 per month for any of the choices (**please circle one**)?

a) No

b) Yes – If "Yes" please state how much you would pay: $__________ per month.

11) If you chose a treatment option, it was because (**please circle all that apply**):

a) It was worth the money.

b) The paid reduction for the level of improvement was a good value.

c) The improvements to pain were good and I knew I did not have to pay for this.

d) I would pay anything to reduce my pain and improve my quality of life.

12) If you **did not** choose any of the treatments, was it because (**please circle all that apply**):

a) I did not believe the level of improvement to my disability or pain intensity.

b) I could not afford the price of the treatment.

c) I do not agree with having to pay for such treatments.

d) The monthly cost of treatment was too expensive.

e) The treatments described are not realistic or do not exist.

13) We would also like to know your opinion about this questionnaire. **Across each row of responses, please check the box that corresponds to your response to the following statements.**

Statements:	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
I was absolutely certain that I would pay the price of the treatments I chose in the survey.					
The survey was easy to understand.					
It was easy to compare and make choices between the treatments.					

14) When you were making your choices between treatments, how much did each of the characteristics below influence your purchase? **Across each row of responses, please check the box that corresponds to your response to the following statements.**

Statements:	**Extremely Important**	**Very Important**	**Somewhat Important**	**Not Important**	**Not Important At All**
Improvement to pain intensity.					
Improvement to disability level.					
Price of treatment per month.					

15) If you have additional comments please write them here: ____________________

____

____

____

APPENDIX 4-F: CONSENT FORM

Study has received ethical approval from the Health Research Ethics Board Panel B (File#B-100106).

CONSENT FORM IS AT A GRADE 7 READING LEVEL

Informed Consent for Questionnaire

TITLE OF PROJECT

Stated Preference Valuation of Chronic Pain Disorders

INVESTIGATORS

Anderson Chuck, Ph: (780) 448-4881
Dept of Public Health Sciences, University of Alberta,

Vic Adamowicz, Ph: (780) 492-4603
Dept of Rural Economy, University of Alberta,

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Dept of Public Health Sciences, University of Alberta,

Saifudin Rashiq Ph: (780) 407-8861 & Bruce Dick, Ph: (780) 407-1097
Dept of Anesthesiology/Pain Medicine, University of Alberta,

PURPOSE AND BACKGROUND

We are trying to better understand your experience of pain. We are asking that you participate in a survey that will help us better understand the value of pain improvement. Your participation is greatly appreciated and we encourage you to participate.

This survey is strictly for research purposes and is not part of your regular visit. The results will not be part of your medical record.

PROCEDURES

If you agree to complete the survey, the following will occur:

1. You will be asked to sign the attached consent form.
2. A researcher will explain the instructions and background information.

3. You will be asked to complete a questionnaire which will take approximately 15 minutes.

VOLUNTARY PARTICIPATION

Your participation is completely voluntary. You are free to not participate. You are free to quit at any time. There will be NO consequence if you do not participate or if you quit. **Your participation or non-participation will not in any way affect your treatment or your ability to receive treatment.**

CONFIDENTIALITY

All information will be confidential. Information about your age, gender, pain condition, pain history, and pain treatment will be collected from your patient chart. However, information about your identity (example: name or address) will not be recorded and your responses cannot be traced. **An anonymous coded number will be used to link your survey responses to the information collected from your patient chart. However this code will be stored separately from any collected data to ensure your confidentiality.**

In order to collect the needed information for this research we will have to access your patient chart which is in the custody of Capital Health. By signing this consent form you give us, the researchers, permission to access your patient chart to collect the information necessary to complete this research.

RISKS

There are no risks to you for filling out this survey. Your identity will be anonymous. All information will be kept in locked files at all times. Your anonymous coded number will be stored separately from any collected data. Only authorized personnel will have access to any information.

DIRECT BENEFITS

There is no DIRECT benefit to you for participating. But an INDIRECT benefit is that it gives you the opportunity to tell us the value you place on improvements to your pain.

CONTACT INFORMATION

We are free to answer any of your questions. If you have any further questions about the study, please contact:

Anderson Chuck
Department of Public Health Sciences
University of Alberta, 13-103 Clinical Sciences Building
Edmonton, Alberta, T6G 2G3
Phone: (780) 448-4881
Email: achuck@ualberta.ca

Should there be any questions regarding one's rights as a participant, please call the Patient Concerns Office of Capital Health at 407-1040.

CONSENT

Title of Project: Stated Preference Valuation of Chronic Pain Disorders

Do you understand that you have been asked to participate in a research study?	Yes	No
Have you read and received a copy of the attached Information Sheet?	Yes	No
Do you understand the benefits and risks involved in taking part in this research study?	Yes	No
Have you had an opportunity to ask questions and discuss this study?	Yes	No
Do you understand that you are free to refuse to participate or withdraw from the study at any time? You do not have to give a reason and it will not affect your care.	Yes	No
Has the issue of confidentiality been explained to you?	Yes	No
Do you understand that the research requires accessing your medical charts which contains personally identifiable health information? Do you understand who will have access to your records and what information will be collected?	Yes	No

This study was explained to me by: Anderson Chuck

I agree to take part in this study.

Signature of Research Participant ______ Date ______ Witness ______

Printed Name ______ Anderson Chuck Printed Name

I believe that the person signing this form understands what is involved in the study and voluntarily agrees to participate.

Signature of Investigator or Designee ______ Date ______

THE INFORMATION SHEET MUST BE ATTACHED TO THIS CONSENT FORM AND A COPY GIVEN TO THE RESEARCH SUBJECT

APPENDIX 4-G: INSTRUCTIONS AND WTP RESPONSE FORM

RESEARCH QUESTIONNAIRE ABOUT PAIN

Please complete this survey about pain relief.

This will only take a few minutes.

Your answers will be private and will be used for research only.

THANK YOU FOR YOUR HELP. PLEASE SIGN THE ATTACHED CONSENT FORM BEFORE STARTING.

INSTRUCTIONS

You have shown me that you have __________ and __________. The treatments can improve your disability and reduce your Pain.

In this survey you will be presented with a series of choices between two **totally hypothetical** treatments A and B. **Show example question**

Treatments A and B differ according to:

1. **Level of improvement on your Pain Related Disability (depends on baseline)**:
2. **Level of improvement on your Pain Intensity (depends on baseline)**:
3. **Cost of treatment per month to you after any insurance**:

All other aspects of the treatments are identical. Meaning they are the same in terms of their side effects, duration, and mode of administration.

For each choice question compare the differences between the two treatments and choose the treatment you would buy. If you would not buy either treatment choose neither treatment.

These scenarios are hypothetical which have caused people to choose a treatment that costs more than they would actually be willing to pay if that treatment became available in reality. We need to know what you would be willing to pay in reality.

For this reason, pretend the choices are real. When comparing treatments A and B, imagine you actually were required to pay the price of the treatment you choose. Please be honest with your choice.

TURN OVER THE PAGE TO BEGIN THE QUESTIONNAIRE

EXAMPLE

If Neither - Reason:

Please Circle One:

Treatment A   Treatment B   Neither

PRACTICE 1

Please Circle One:

Treatment A   Treatment B   Neither

PRACTICE 2

Please Circle One:

Treatment A   Treatment B   Neither

CHOICE 1

Please Circle One:

Treatment A   Treatment B   Neither

CHOICE 2

Please Circle One:

Treatment A   Treatment B   Neither

CHOICE 3

Please Circle One:

Treatment A   Treatment B   Neither

CHOICE 4

Please Circle One:

Treatment A   Treatment B   Neither

If Neither - Reason:

CHOICE 5

Please Circle One:

Treatment A Treatment B Neither

CHOICE 6

Please Circle One:

Treatment A Treatment B Neither

CHOICE 7

Please Circle One:

Treatment A Treatment B Neither

CHOICE 8

Please Circle One:

Treatment A Treatment B Neither

CHOICE 9

Please Circle One:

Treatment A Treatment B Neither

CHOICE 10

Please Circle One:

Treatment A Treatment B Neither

CHOICE 11

Please Circle One:

Treatment A Treatment B Neither

If Neither - Reason:

CHOICE 12

Please Circle One:

Treatment A Treatment B Neither

CHOICE 13

Please Circle One:

Treatment A Treatment B Neither

CHOICE 14

Please Circle One:

Treatment A Treatment B Neither

CHOICE 15

Please Circle One:

Treatment A Treatment B Neither

CHOICE 16

Please Circle One:

Treatment A Treatment B Neither

CHOICE 17

Please Circle One:

Treatment A Treatment B Neither

CHOICE 18

Please Circle One:

Treatment A Treatment B Neither

CHOICE 19 If Neither - Reason:

Please Circle One:

Treatment A Treatment B Neither

CHOICE 20

Please Circle One:

Treatment A Treatment B Neither

CHOICE 21

Please Circle One:

Treatment A Treatment B Neither

CHOICE 22

Please Circle One:

Treatment A Treatment B Neither

CHOICE 23

Please Circle One:

Treatment A Treatment B Neither

CHOICE 24

Please Circle One:

Treatment A Treatment B Neither

CHOICE 25

Please Circle One:

Treatment A Treatment B Neither

CHOICE 26 If Neither - Reason:

Please Circle One:

Treatment A Treatment B Neither

CHOICE 27

Please Circle One:

Treatment A Treatment B Neither

CHOICE 28

Please Circle One:

Treatment A Treatment B Neither

CHOICE 29

Please Circle One:

Treatment A Treatment B Neither

CHOICE 30

Please Circle One:

Treatment A Treatment B Neither

CHOICE 31

Please Circle One:

Treatment A Treatment B Neither

CHOICE 32

Please Circle One:

Treatment A Treatment B Neither

CHOICE 33

If Neither - Reason:

Please Circle One:

Treatment A Treatment B Neither

CHOICE 34

Please Circle One:

Treatment A Treatment B Neither

CHOICE 35

Please Circle One:

Treatment A Treatment B Neither

CHOICE 36

Please Circle One:

Treatment A Treatment B Neither

CHOICE 38

Please Circle One:

Treatment A Treatment B Neither

CHOICE 39

Please Circle One:

Treatment A Treatment B Neither

PLEASE TAKE A MINUTE TO ANSWER THE QUESTIONS ON THE BACKGROUND QUESTIONNAIRE
(Please answer all questions)

APPENDIX 4-H: FRAMEWORK FOR RANDOM UTILITY MODEL

Theory

The theoretical framework for CV is derived from multi-attribute utility theory, which postulates that utility is derived from the various attributes that characterize the properties of a given good.[1]

This can be characterized by the function:

$$U_{ijr} = V_i(X_{ijr} p_{ijr}; Z_i, \beta_i, \delta_i) + e_{ijr}$$

Where Uijr = individual i's utility for alternative r in choice set j.
Vi() is the non-stochastic (non-random) part of the utility function.
Xijr is a vector of attribute levels (except for price) in choice set j for alternative r
pijr is a scalar representing the price level attribute in choice set j for alternative r
Zi is a vector of personal characteristics (age, gender, education, income, severity,
Bi is a vector of attribute parameters
δi is the price parameter

Model Estimation

The binary logit model is derived from the assumption that the error terms of the utility functions are independent and identically Gumbel distributed. Generalizing this assumption to cases where there are more than two alternatives is referred to as *multinomial* logit models.
Specifically, in models with choices between multiple alternatives, there are often no natural ordering among alternatives and a monotonic relationship between the underlying latent variable and the observed outcomes cannot be assumed as with binary choices.[2]
Accordingly, while still assuming a Type I extreme value distribution, multinomial logit models can be used to estimate models with multiple alternatives.

Accordingly, the choice probability for this random utility model for multiple alternatives in general is:

$$P_i = \frac{\exp(V_i)}{\sum_{j=1}^{J} \exp(V_{j)}}, 1, \ldots, J,$$

Accordingly, the regression equation based on the example of identified attributes and levels is as follows:

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[1] Lancaster KJ. A new approach to consumer theory. The Journal of Political Economy 1966; 74:132-157.

[2] Verbeek M. A guide to modern econometrics. 2nd ed. Hoboken: NJ: John Wiley & Sons Ltd., 2004

$\Delta U = \beta_0 + \beta_1$ mild disability + β_2 moderate disability + β_3 severe disability + β_4 mild pain + β_5 moderate pain + β_6 severe pain + β_7 demographics + β_7 clinical factors + δ_1 price + e_{ij}

The requirement for a Nested Model

The multinomial logit model assumes that all error terms associated for each choice by a particular individual are independent implying that the utility levels for any two alternatives are independent (assumption of independent and irrelevant alternatives - IIA).[2] However, this is problematic for alternatives which similar characteristics because there is the potential violation of the IIA assumption (the ratio of probabilities for any two alternatives are independent from the choice set).[2] That is in choice experiment with similar attributes, the probabilities within attributes (e.g., pain disability) do not vary independently from other attributes (e.g., pain intensity). Therefore, a nested multinomial logit model is used to ensure that the IIA assumption holds within attribute groups but not across attributes.[2]

Model Fit

Assessment of model fit will be conducted with Pseudo R – Squared Values and likelihood ratio tests.[2] Pseudo R – Squared is the change in terms of log-likelihood from the intercept-only model to the current model. This goodness of fit measures are based on comparisons with a model that contains only a constant as explanatory variable.

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[2] Verbeek M. A guide to modern econometrics. 2nd ed. Hoboken: NJ: John Wiley & Sons Ltd., 2004

APPENDIX 4-I: SAMPLE SIZE POWER CALCULATIONS

Formula for sample size calculation for choice experiments:[1]

$$n \geq \frac{q}{pa^2}\left[\phi^{-1}\left(1-\frac{\alpha}{2}\right)\right]^2 \Big/ r$$

n = minimum number of respondents.
p = true choice proportion of relevant population.
q = 1- p.
a = level of allowable deviation as a % from the true choice proportion.
α = level of accuracy (Type I Error).
r = number of tasks (i.e., choice scenarios/questions).
$\phi^{-1}\left(1-\frac{\alpha}{2}\right)$ = inverse cumulative distribution function of a standard normal [i.e. N~(0,1)] taken at $1-\frac{\alpha}{2} = 1.96$.

REQUIRED SAMPLE SIZE FOR PRESENTING HEALTH STATES

Parameters	TDEP	TDSP	TDMP	SDEP	SDSP	SDMP	MDEP	MDSP
p	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
q	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
a	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
α	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
$\phi^{-1}\left(1-\frac{\alpha}{2}\right)$	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
r	18	13	9	13	10	3	9	3
Sample size	21	30	43	30	38	128	43	128

Note: WTP was not assessed in individuals presenting with other health states because no individuals presented with MDMP or mild pain intensity or disability during pilot testing.

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[1] Hensher DA, Rose JM, Greene WH. Applied choice analysis: A primer. Cambridge: Cambridge University Press, 2005

APPENDIX 4-J: BIAS ISSUES AND REMEDIES

Bias/Issue	Description	Methods to Minimize
Editing Bias[1]	Tendency for individuals to revise information outlined in the survey.	Description of health states and monetary benefits will be clearly explained to ensure participants understand the health context. Questionnaire will be piloted on a sub-group of participants to identify potential problems.
Sequencing Bias[1]	Tendency to provide different answers due to the order in which questions are given.	Questions will be presented in random order.
Hypothesis Bias[1]	Tendency to provide higher/lower WTP values than would be the case in a real market.	Various methods will be employed to ensure consequentiality. These will include cheap talk[3] (discussion of the hypothetical bias problem that induces respondents to eliminate their bias), uncertainty questions (debriefing strategy that measures validity of responses).[3]
Social Desirability Bias[1]	Tendency to provide what they believe is the desired response rather than their true valuation.	Debriefing component will be included in CV questionnaire to assess the participant's reasoning in answering questions.
Protest Bias[1]	Tendency for respondents to indicate they would not pay any money for an improvement in pain because they object to the CV exercise.	Respondents will be able to select a "prefer not to answer" alternative which can then be recorded as missing rather than zero. A sensitivity analysis that includes/excludes protest responders will also be conducted.
Non-response Bias[1]	Tendency to avoid answering questions altogether.	Debriefing component will be added to CV questionnaire to assess the participant's reasoning in answering questions.
Trade off Consistency	Are individuals behaving in a compensatory manner?	Respondents will consider the same discrete choice comparison early in the survey and at the end. Respondents are expected to make the same choice both times the question is presented.
Content Validity	In the context of CV, this refers to the respondents understanding of the questionnaire and that the context, attributes, and levels are relevant to the respondent.	Sensitivity analysis will assess whether respondent's WTP for relief increased as the relief scenario is improved.[1] WTP should also be higher for individuals with greater incomes and higher for attributes that respondent indicates is important (e.g. prefers pain relief over disability improvement).
Cognitive Burden[2]	Cognitive fatigue caused by respondents having to answer increasing numbers of choice sets.	Piloting testing will identify the presence of cognitive burden. If present, different choice sets will be randomly distributed over three survey versions consisting of approximately 10 questions each (pending information garnered through focus groups, interviews, and pilot testing). Participants will randomly receive one of the three versions.

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[1] Bayoumi AM. The Measurement of Contingent Valuation for Health Economics. Pharmacoeconomics 2004; 22(11):691-700.

[2] Zwerina K, Huber J, Kuhfeld J. A general method for constructing efficient choice designs. Durham, NC: Fuqua School of Business, Duke University, 1996.

[3] Cummings RG, Taylor LO. Unbiased value estimates for environmental goods: a cheap talk design for contingent valuation method. American Economic Review 1999; 89:649-655.

APPENDIX 4-K: SELECTED ANECDOTAL COMMENTS

- "Pain does not affect my overall quality of life. Pain is something you overcome."

- "My pain has ruined my life."

- "My pain has crippled me. There is no enjoyment anymore."

- "Would pay any amount to be pain free."

- "Pain changes all the time. Some days I feel I can manage, but then later on in the day I can't."

- "I have tried everything and nothing works. Living with pain is hopeless."

- "I feel that if I didn't have any pain, then everything else would be fine."

- "It's a never ending cycle. Because of pain I cannot work and if I can't work then I can't afford the medications."
- "Learning to accept that I might have to live with this for the rest of my life was really hard. But life goes on and you have to do what you can."

- "When on disability, people cannot afford to pay a great deal of money. If a person could fix all problems without a price tag, we wouldn't have so many people on disability.

- " I have taken part in a couple of studies because if possible I would love to find a treatment that can help with pain and allow me to perform daily tasks easier."

- "I would pay anything to reduce my pain."

APPENDIX 4-L: RESULTS FOR BASE MODEL

Multinomial Regression for Base Model

Attributes	SDEP		SDSP		MDSP		MDEP + SDEP [a]		All	
	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]
Constants										
Constant treatment A	0.789*	$229	0.040		0.261		0.668*	$206	0.211	
Constant treatment B	0.119		-0.003		-0.037		0.027		-0.081	
Disability Improvement										
Reduced To Mild	0.888*	$258	0.787*	$299	0.961*	$382	0.839*	$258	0.929*	$361
Reduced To Moderate	0.555*	$161	0.285	$110			0.568*	$175	0.538*	$209
Pain Improvement										
Reduced To Mild	4.114*	$1196	2.860*	$1088	2.267*	$900	3.846*	$1183	2.742*	$1067
Reduced To Moderate	2.581*	$750	1.665*	$633	1.531*	$608	2.417*	$744	1.750*	$681
Reduced To Severe	0.852*	$248					0.830*	$255	0.577*	$225
Price	-0.0034*	—	-0.0026*	—	-0.0025*	—	-0.0033*	—	-0.0026*	—
Pseudo-R-Squared	0.45		0.31		0.21		0.42		0.28	

a. MDEP is pooled with MDSP because there were only 3 individuals who presented with MDEP.

b. Compared to no improvement.
Marginal WTP per month = βi / βprice. Note that only statistically significant coefficients are included in the calculation of WTP.

* Statistically significant at $p < .05$.

APPENDIX 4-M: RESULTS FOR BASE + EXOGENOUS MODEL

Results for Multinomial Regression for Base + Exogenous Model

Attributes	SDEP		SDSP		MDSP		MDEP + SDEP [a]		All	
	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]
Constants										
Constant treatment A	1.20*	$231	0.27	$73	0.34	$117	1.01*	$230	0.33*	$114
Constant treatment B	0.31	$60	0.24	$65	0.02	$7	0.25	$57	0.02	$7
Disability Improvement										
Reduced To Mild	2.44*	$469	0.42*	$114	2.48*	$855	1.79*	$407	1.08*	$372
Reduced To Moderate	1.71*	$329	1.37*	$470			1.38*	$314	1.59*	$548
Pain Improvement										
Reduced To Mild	12.44*	$2,392	1.74*	$370	4.50*	$1,552	11.27*	$2,561	3.66*	$1,262
Reduced To Moderate	7.93*	$1,525	-0.73*	-$197	3.48*	$1,200	7.48*	$1,700	2.39*	$824
Reduced To Severe	3.36	$646					3.40	$773	1.35	$466
Price	-.0052*		-.0037*		-.0029*		-.0044*		-.0029*	
Demographic										
MildD × Age	0.03	$6	0.01	$3	-0.01	-$3	-0.03	-$7	-0.01	-$3
ModD × Age	0.03	$6	-0.01	-$3			0.00*	$0	-0.01	-$3
MildP × Age	-0.29*	-$56	-0.04*	-$11	-0.03*	-$10	-0.22*	-$50	-0.03*	-$10
ModP × Age	-0.20*	-$38	0.01	$3	-0.01	-$3	-0.16	-$36	-0.01	-$3
SevP × Age	-0.08	-$15					-0.07	-$16	-0.01	-$3
MildD × Gender	0.35	$67	-0.26	-$70	-0.04	-$14	-0.30	-$68	0.05	$17
ModD × Gender	0.26	$50	-0.55	-$149			-0.24	-$55	-0.06	-$21

Continued Results for Multinomial Regression for Base + Exogenous Model

Attributes	SDEP		SDSP		MDSP		MDEP + SDEP [a]		All	
	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]
MildP × Gender	1.14	$219	0.54	$146	0.14	$48	0.71	$161	0.28*	$97
ModP × Gender	1.42*	$273	0.24	$65	0.01	$1	0.64	$145	0.15	$52
SevP × Gender	0.50	$96					-0.45	-$102	-0.54*	-$186
MildD × Married	0.69	$133	0.09	$24	0.85*	$293	0.53	$120	0.40*	$138
ModD × Married	0.18	$35	-0.25	-$68			0.09	$20	-0.03	-$10
MildP × Married	0.99	$190	0.29	$78	0.29	$100	0.63	$143	0.18	$62
ModP × Married	0.55	$106	0.23	$62	0.06	$21	0.36	$82	0.05	$17
SevP × Married	-0.89	-$171					-0.04	-$9	-0.06	-$21
MildD × Smoker	0.05	$10	0.42	$114	-0.08	-$28	-0.46	-$105	0.07	$24
ModD × Smoker	0.45	$87	0.65*	$176			0.14	$32	0.36*	$124
MildP × Smoker	-0.43	-$83	0.80*	$216	-0.38	-$131	-0.67	-$152	0.21	$72
ModP × Smoker	0.01	$2	0.31	$84	-0.37	-$128	-0.41	-$93	0.08	$28
SevP × Smoker	-1.10*	-$212					-0.95*	-$216	-0.69*	-$238
MildD × Education	1.51*	$290	0.49	$132	0.17	$59	0.12	$27	0.15	$52
ModD × Education	0.56	$108	0.30	$81			-0.20	-$45	-0.01	-$3
MildP × Education	-0.24	-$46	-0.28	-$76	0.00	$0	0.57	$130	0.03	$10
ModP × Education	-0.12	-$23	-0.27	-$73	0.11	$38	0.28	$64	-0.01	-$3

Continued Results for Multinomial Regression for Base + Exogenous Model

Attributes	SDEP		SDSP		MDSP		MDEP + SDEP [a]		All	
	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]
SevP × Education	1.15	$221					0.13	$30	0.01	$3
MildD × Income 30-59	1.42*	$273	0.75*	$203	0.38	$131	0.38	$86	0.45*	$155
ModD × Income 30-59	0.70	$135	0.19	$51			0.07	$16	0.11	$38
MildP × Income 30-59	0.14	$27	1.49*	$403	-0.37	-$128	0.62	$141	0.16	$55
ModP × Income 30-59	0.16	$31	0.58	$157	-0.17	-$59	0.53	$120	0.03	$10
SevP × Income 30-59	0.03	$6					0.19	$43	-0.03	-$10
MildD × Income >59k	-2.39*	-$460	-0.07	-$19	-0.47	-$162	0.49	$111	-0.13	-$45
ModD × Income >59k	-1.44	-$277	0.55	$149			0.22	$50	0.20	$69
MildP × Income >59k	3.16*	$608	1.27*	$343	1.08*	$372	2.13*	$484	1.03*	$355
ModP × Income >59k	1.08	$208	1.27*	$343	0.50	$172	1.18*	$268	0.69*	$238
SevP × Income >59k	-0.74	-$142					0.88	$200	0.66	$228
Clinical										
MildD × Time at clinic	0.02	$4	0.02*	$5	-0.03*	-$10	-0.01	-$2	0.01	$0
ModD × Time at clinic	0.00*	$0	0.01	$3			-0.01	-$2	0.01	$0
MildP × Time at clinic	-0.04*	-$8	0.01	$3	-0.02	-$7	-0.02	-$5	0.01	$0
ModP × Time at clinic	-0.04*	-$8	-0.01	-$3	-0.03*	-$10	-0.02	-$5	-0.01*	-$3
SevP × Time at clinic	-0.05*	-$10					-0.02	-$5	-0.02	-$7

Continued Results for Multinomial Regression for Base + Exogenous Model

Attributes	SDEP		SDSP		MDSP		MDEP + SDEP [a]		All	
	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]
MildD × Yrs with pain	-0.18	-$35	-0.03	-$8	0.08*	$28	-0.01	-$2	0.00	$0
ModD × Yrs with pain	-0.10	-$19	-0.06	-$16			-0.03	-$7	-0.04	-$14
MildP × Yrs with pain	0.22	$42	0.06*	$16	-0.01	-$3	0.01	$2	0.00	$0
ModP × Yrs with pain	0.27	$52	0.07*	$19	0.03	$10	0.00	$0	0.00	$0
SevP × Yrs with pain	0.46*	$88					0.03	$7	0.02	$7
MildD × # Comorb	-0.74	-$142	-0.05	-$14	-0.24	-$83	0.39	$89	0.00	$0
ModD × # Comorb	-0.61	-$117	-0.26	-$70			0.01	$2	-0.13	-$45
MildP × # Comorb	2.30*	$442	0.77	$208	-0.02	-$7	1.62*	$368	0.07	$24
ModP × # Comorb	1.44*	$277	0.45	$122	-0.12	-$41	1.27*	$289	0.00	$0
SevP × # Comorb	-0.18	-$35					0.59	$134	0.16	$55
MildD × Depression	-0.01	-$2	0.04	$11	-0.64*	-$221	-0.14	-$32	-0.25*	-$86
ModD × Depression	-0.11	-$21	0.22	$59			-0.04	-$9	0.13	$45
MildP × Depression	-1.87*	-$360	-0.80	-$216	-0.57*	-$197	-0.72	-$164	-0.29*	-$100
ModP × Depression	-1.95*	-$375	-0.65	-$176	-0.19	-$66	-0.74	-$168	-0.07	-$24
SevP × Depression	0.33	$63					0.43	$98	0.54	$186
Pseudo-R-Squared	0.98		0.71		0.38		0.76		0.41	

a. MDEP is pooled with MDSP because there were only 3 individuals who presented with MDEP.

b. Compared to no improvement.
Marginal WTP per month = βi / βprice. Note that only statistically significant coefficients are included in the calculation of WTP.

* Statistically significant at $p < .05$.

APPENDIX 4-N: BASE + EXOG + ENDOGENOUS MODEL

Results for Multinomial Regression for Base + Exogenous +Endogenous Model

Attributes	SDEP		SDSP		MDSP		MDEP + SDEP ^{a}		All	
	β	Marginal WTP ^{b}	β	Marginal WTP ^{b}	β	Marginal WTP ^{b}	β	Marginal WTP ^{b}	β	Marginal WTP ^{b}
Constants										
Constant treatment A	1.236*	$228	0.353	$90	0.468	$154	0.933*	$192	0.318	$105
Constant treatment B	0.318	$59	0.330	$84	0.131	$43	0.097	$20	-0.006	-$2
Disability Improvement										
Reduced To Mild	2.459*	$454	0.554*	$142	2.425*	$798	3.871*	$798	1.014*	$335
Reduced To Moderate	1.965	$363	2.573*	$658			1.321*	$272	1.508*	$498
Pain Improvement										
Reduced To Mild	11.357*	$2,097	0.437*	$112	3.762*	$1,238	9.836*	$2,029	3.159*	$1,043
Reduced To Moderate	6.531*	$1,206	-2.238*	-$572	2.922*	$962	5.350*	$1,103	2.035*	$672
Reduced To Severe	3.226*	$596					3.026*	$624	1.018	$336
Price	-0.0054*		-0.0039*		-0.0030*		-0.0048*		-0.0030*	
Demographic										
MildD × Age	0.056	$10	0.011	$3	-0.007	-$2	-0.070	-$15	-0.010	-$3
ModD × Age	0.076	$14	-0.001	$0			-0.161	-$33	0.010	$3

Continued Results for Multinomial Regression for Base + Exogenous +Endogenous Model

Attributes	SDEP		SDSP		MDSP		MDEP + SDEP [a]		All	
	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]
MildP × Age	-0.436	-$81	-0.007	-$2	-0.020	-$7	-0.388*	-$80	-0.021*	-$7
ModP × Age	-0.335*	-$62	0.039	$10	-0.006	-$2	-0.240*	-$49	-0.002	-$1
SevP × Age	-0.049*	-$9		$0			-0.076	-$16	0.004	$1
MildD × Gender	0.586	$108	0.207	$53	-0.111	-$37	-0.200	-$41	0.044	$15
ModD × Gender	0.747	$138	-0.249	-$64			-0.226	-$47	-0.162	-$53
MildP × Gender	-0.594	-$110	0.723*	$185	-0.089	-$29	1.451	$299	0.289*	$95
ModP × Gender	-0.324	-$60	0.332	$85	-0.175	-$58	0.865	$178	0.166	$55
SevP × Gender	0.749	$138					-0.046	-$9	-0.344	-$113
MildD × Married	0.418	$77	0.841	$215	0.820*	$270	0.008	$2	0.437*	$144
ModD × Married	-0.773	-$143	0.074	$19			2.044	$422	-0.304	-$100
MildP × Married	4.003*	$739	0.333	$85	0.525*	$173	-3.066*	-$632	0.130	$43
ModP × Married	3.666*	$677	0.444	$114	0.249	$82	-1.104	-$228	0.037	$12
SevP × Married	-1.406	-$260					-0.149	-$31	0.563	$186
MildD × Smoker	0.159	$29	0.047	$12	-0.517*	-$170	-0.356	-$73	0.059	$19
ModD × Smoker	0.741	$137	0.071	$18			3.398	$701	0.235	$77
MildP × Smoker	-1.527	-$282	0.031	$8	-0.653*	-$215	-0.342	-$71	0.049	$16
ModP × Smoker	-0.969	-$179	-0.223	-$57	-0.621	-$204	-0.575	-$119	-0.029	-$9

Continued Results for Multinomial Regression for Base + Exogenous +Endogenous Model

Attributes	SDEP		SDSP		MDSP		MDEP + SDEP [a]		All	
	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]
SevP × Smoker	-1.081*	-$200					-0.564	-$116	-0.531	-$175
MildD × Education	1.763*	$325	1.015*	$259	0.115	$38	-0.008	-$2	0.272	$90
ModD × Education	0.919	$170	0.320	$82			-4.197	-$866	-0.066	-$22
MildP × Education	-1.359	-$251	-0.001	$0	0.180	$59	-0.253	-$52	0.101	$33
ModP × Education	-1.246	-$230	0.388	$99	0.244	$80	0.102	$21	0.080	$26
SevP × Education	1.371*	$253					0.006	$1	0.139	$46
MildD × Income 30-59	1.146	$212	0.072	$18	0.281	$93	-0.257	-$53	0.563*	$186
ModD × Income 30-59	-0.208	-$38	-0.916	-$234			-1.176	-$243	0.056	$19
MildP × Income 30-59	2.685*	$496	0.973	$249	-0.278	-$91	-2.948	-$608	0.191	$63
ModP × Income 30-59	2.940	$543	0.558	$143	-0.091	-$30	-0.624	-$129	0.091	$30
SevP × Income 30-59	-0.587	-$108					-0.591	-$122	0.130	$43
MildD × Income >59k	-2.406	-$444	-0.731	-$187	-0.280	-$92	0.993	$205	-0.252	-$83
ModD × Income >59k	-1.146*	-$211	0.158	$40			1.662	$343	0.272	$90
MildP × Income >59k	2.872	$530	0.862*	$220	0.856*	$282	4.081*	$842	0.842*	$278
ModP × Income >59k	0.338	$62	0.794*	$203	0.315	$104	1.556	$321	0.522*	$172
SevP × Income >59k	-0.393	-$73					1.472	$304	0.693	$229
Clinical										
MildD × Time at clinic	0.010	$2	0.011	$3	-0.037*	-$12	-0.010	-$2	0.006*	$2
ModD × Time at clinic	-0.013	-$2	-0.005	-$1			0.018	$4	-0.001	$0
MildP × Time at clinic	0.016	$3	0.006	$2	-0.034*	-$11	-0.080*	-$17	0.004	$1
ModP × Time at clinic	0.016	$3	-0.017*	-$4	-0.041*	-$14	-0.044	-$9	-0.009*	-$3

Continued Results for Multinomial Regression for Base + Exogenous +Endogenous Model

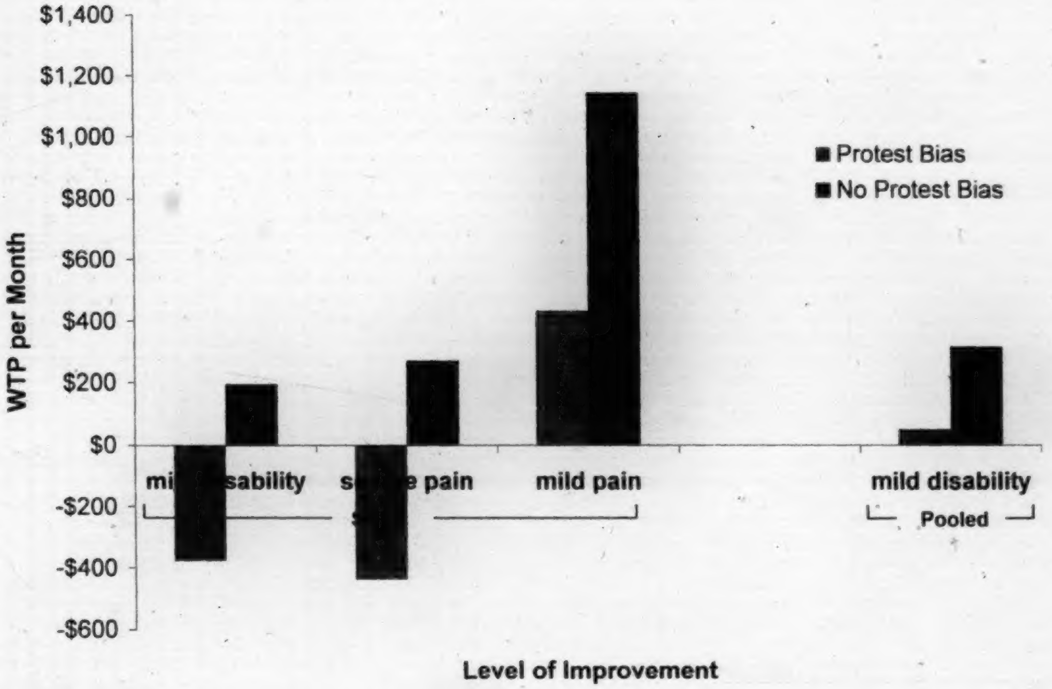
Attributes	SDEP		SDSP		MDSP		MDEP + SDEP [a]		All	
	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]
SevP × Time at clinic	-0.061*	-$11					-0.029	-$6	-0.009	-$3
MildD × Yrs with pain	-0.211	-$39	0.112	$29	0.090*	$30	0.001	$0	0.012	$4
ModD × Yrs with pain	-0.139	-$26	-0.049*	-$13			-0.077	-$16	-0.099*	-$33
MildP × Yrs with pain	0.326	$60	0.047*	$12	0.009	$3	0.083	$17	-0.002	-$1
ModP × Yrs with pain	0.389*	$72	0.117*	$30	0.040	$13	0.046	$9	0.009	$3
SevP × Yrs with pain	0.450*	$83					0.034	$7	0.009	$3
MildD × # Comorb	-0.977	-$180	-0.221	-$57	-0.234	-$77	0.235	$48	-0.034	-$11
ModD × # Comorb	-1.226	-$226	-0.559	-$143			-1.221	-$252	-0.124	-$41
MildP × # Comorb	4.418*	$815	0.675	$172	-0.067	-$22	1.311	$270	0.120	$40
ModP × # Comorb	3.452*	$637	0.502	$128	-0.147	-$48	1.687*	$348	0.030	$10
SevP × # Comorb	-0.436	-$80					0.261	$54	0.057	$19
MildD × Depression	0.479	$88	0.146	$37	-0.506*	-$167	0.152	$31	-0.147	-$49
ModD × Depression	1.390	$257	1.250	$319			-4.237	-$874	0.442	$146
MildP × Depression	-6.496*	-$1,199	-0.496	-$127	-0.430	-$142	1.391	$287	-0.178	-$59
ModP × Depression	-6.780*	-$1,252	-1.281*	-$327	-0.056	-$19	-0.079	-$16	0.022	$7
SevP × Depression	1.080	$199					0.676	$139	0.198	$65
Attribute Preference										
MildD × pain extimport	1.619	$299	-0.624	-$160	-0.523*	-$172	0.402	$83	-0.200	-$66
ModD × pain extimport	0.689	$127	-0.011	-$3			-5.550	-$1,145	0.378	$125

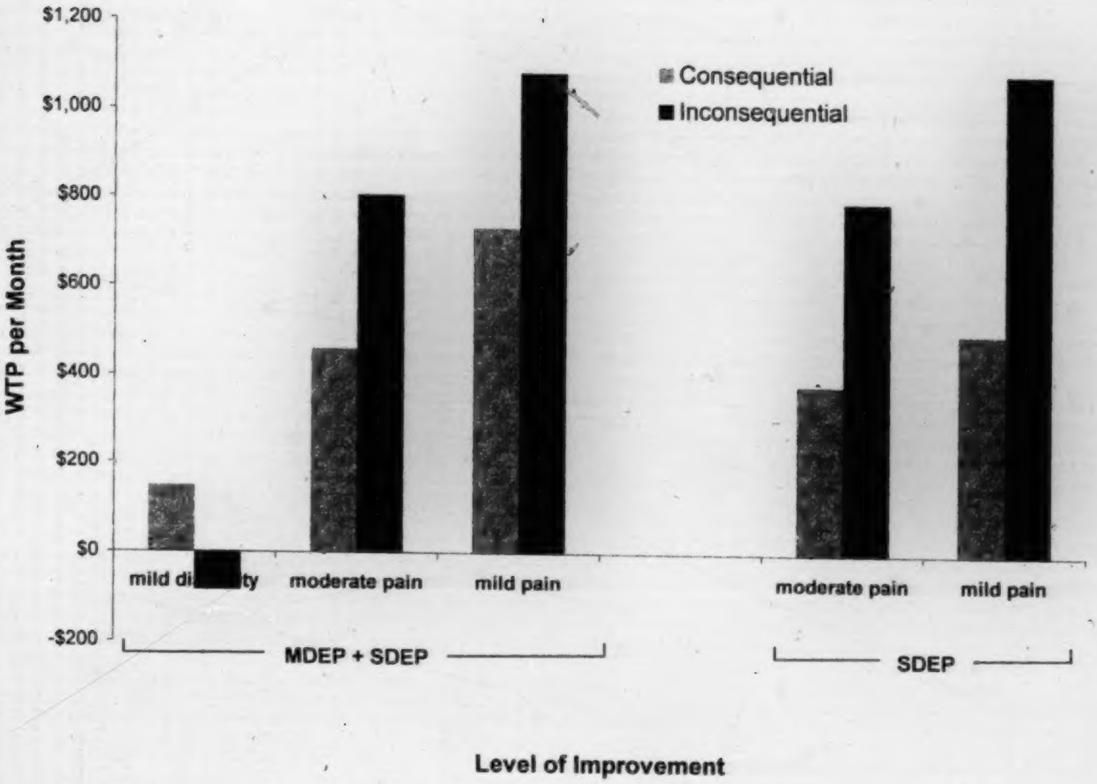
Continued Results for Multinomial Regression for Base + Exogenous +Endogenous Model

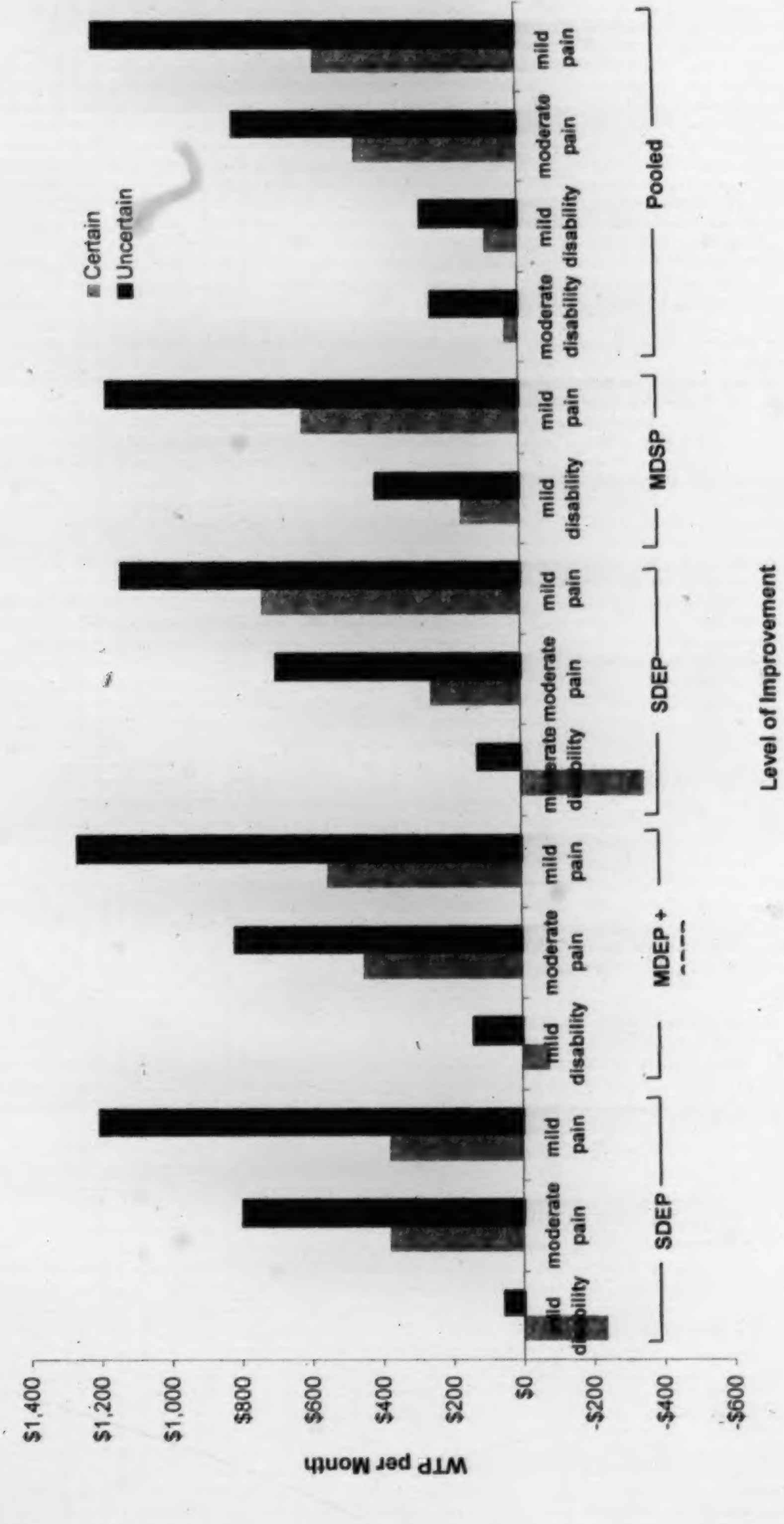
Attributes	SDEP		SDSP		MDSP		MDEP + SDEP [a]		All	
	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]	β	Marginal WTP [b]
MildP × pain extimport	5.153	$951	0.743*	$190	0.080	$26	4.572*	$943	0.525*	$173
ModP × pain extimport	4.940*	$912	0.382*	$98	0.034	$11	2.563*	$529	0.335*	$110
SevP × pain extimport	0.948	$175					0.138	$29	0.034	$11
MildD × dis extimport	2.175	$402	1.332*	$340	0.747*	$246	6.155	$1,270	0.686*	$227
ModD × dis extimport	1.090	$201	0.729	$186			1.123	$232	0.290	$96
MildP × dis extimport	2.299*	$424	1.229	$314	0.138	$45	5.295*	$1,092	0.619	$204
ModP × dis extimport	0.799	$147	0.650	$166	-0.030	-$10	-1.786	-$368	0.101	$33
SevP × dis extimport	-0.390	-$72					-5.680	-$1,172	-0.043	-$14
MildD × $ extimport	-3.726	-$688	-0.651	-$166	-0.589*	-$194	-0.527	-$109	-0.610*	-$201
ModD × $ extimport	0.686	$127	-1.605	-$410			-0.172	-$35	-0.204	-$67
MildP × $ extimport	-3.415*	-$630	-0.565	-$144	-1.246*	-$410	-7.446	-$1,536	-0.597*	-$197
ModP × $ extimport	0.447*	$83	-0.054	-$14	-1.008*	-$332	-1.364	-$281	-0.543*	-$179
SevP × $ extimport	0.735	$136					-0.911	-$188	-0.386	-$127
Pseudo-R-Squared	0.99		0.87		0.46		0.92		0.46	

a. MDEP is pooled with MDSP because there were only 3 individuals who presented with MDEP. b. Compared to no improvement. Marginal WTP per month = βi / βprice. Note that only statistically significant coefficients are included in the calculation of WTP.
* Statistically significant at $p < .05$.

APPENDIX 4-O: PROTESTS, CONSEQUENTIALITY & UNCERTAINTY




$1,200
$1,000
$800
$600
$400
$200
$0
-$200
WTP per Month
▨ Consequential
■ Inconsequential
mild di ty
moderate pain
mild pain
moderate pain
mild pain
MDEP + SDEP
SDEP
Level of Improvement


WTP per Month
$1,400
$1,200
$1,000
$800
$600
$400
$200
$0
-$200
-$400
-$600
▨ Certain
■ Uncertain
mild disability
moderate pain
mild pain
SDEP
mild disability
moderate pain
mild pain
MDEP +
moderate disability
moderate pain
mild pain
SDEP
mild disability
mild pain
MDSP
moderate disability
mild disability
moderate pain
mild pain
Pooled
Level of Improvement

APPENDIX 4-P: MIXED LOGIT MODEL

Results of Mixed Logit Model for Improvement in Pain Related Morbidity

Attributes	Non Random Parameters	Random Parameters	
	Value	SD	SE
Constants			
Constant treatment A	-1.416	—	—
Constant treatment B	-1.187	—	—
Disability Improvement			
Reduced To Mild	1.053*	0.109	0.138
Reduced To Moderate	1.399*	0.094	0.123
Pain Improvement			
Reduced To Mild	3.472*	0.215	0.188
Reduced To Moderate	2.020*	0.905	0.473
Reduced To Severe	1.568	0.910	0.504
Price	-0.003*	0.0004*	0.0002
Demographic			
MildD × Age	-0.002	—	—
ModD × Age	0.003	—	—
MildP × Age	-0.021*	—	—
ModP × Age	0.002	—	—
SevP × Age	-0.009	—	—
MildD × Gender	-0.027	—	—
ModD × Gender	-0.131	—	—
MildP × Gender	0.183*	—	—
ModP × Gender	0.044	—	—
SevP × Gender	-0.528*	—	—
MildD × Married	0.380*	—	—
ModD × Married	-0.178	—	—
MildP × Married	0.049	—	—
ModP × Married	-0.116	—	—
SevP × Married	-0.075	—	—
MildD × Smoker	0.033	—	—
ModD × Smoker	0.348*	—	—
MildP × Smoker	0.084	—	—
ModP × Smoker	-0.029	—	—
SevP × Smoker	-0.763*	—	—

Continued Results of Mixed Logit Model for Improvement in Pain Related Morbidity

Attributes	Non Random Parameters	Random Parameters	
	Value	SD	SE
MildD × Education	0.149	—	—
ModD × Education	-0.028	—	—
MildP × Education	-0.029	—	—
ModP × Education	-0.058	—	—
SevP × Education	-0.021	—	—
MildD × Income 30-59	0.441*	—	—
ModD × Income 30-59	0.063	—	—
MildP × Income 30-59	0.073	—	—
ModP × Income 30-59	-0.114	—	—
SevP × Income 30-59	-0.109	—	—
MildD × Income >59k	-0.464*	—	—
ModD × Income >59k	0.019	—	—
MildP × Income >59k	0.730*	—	—
ModP × Income >59k	0.376*	—	—
SevP × Income >59k	0.550	—	—
Clinical			
MildD × Time at clinic	0.006	—	—
ModD × Time at clinic	0.000	—	—
MildP × Time at clinic	0.006	—	—
ModP × Time at clinic	-0.012*	—	—
SevP × Time at clinic	-0.015	—	—
MildD × Yrs with pain	0.004	—	—
ModD × Yrs with pain	-0.042	—	—
MildP × Yrs with pain	-0.004	—	—
ModP × Yrs with pain	0.001	—	—
SevP × Yrs with pain	0.020	—	—
MildD × # Comorb	-0.031	—	—
ModD × # Comorb	-0.184	—	—
MildP × # Comorb	0.107	—	—
ModP × # Comorb	0.012	—	—
SevP × # Comorb	0.196	—	—

Continued Results of Mixed Logit Model for Improvement in Pain Related Morbidity

Attributes	Non Random Parameters	Random Parameters	
	Value	SD	SE
MildD × Depression	-0.197	—	—
ModD × Depression	0.284	—	—
MildP × Depression	-0.189	—	—
ModP × Depression	0.079	—	—
SevP × Depression	0.512	—	—

* $p < .05$